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Vol. 43. Ser. A. Part 8. pp. 225–256. AUGUST, 1955.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
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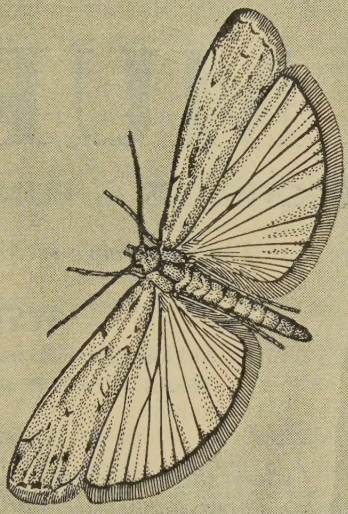

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Schwerdtfeger (F.). **Über die Wirkungsdauer von Hexamitteln bei der Engerlingsbekämpfung.** [On the Duration of Effectiveness of BHC for the Control of Lamellicorn Larvae.]—*Z. PflKrankh.* **61** pt. 1 pp. 9–17, 8 graphs, 13 refs. Ludwigsburg, 1954.

In view of reports of the persistent toxicity of BHC in soil [*cf. R.A.E.*, A **37** 411, 443; **39** 420], tests were carried out on its effectiveness against Lamellicorn larvae. Pots were filled with earth mixed with γ BHC at rates equivalent to 0·006, 0·012 and 0·024 oz. per sq. yard to a depth of 8 ins., stored for up to three years, and infested with field-collected larvae of *Melolontha hippocastani* F., for which food was provided. Larvae in the second and third instars were weighed individually and observed for mortality weekly for 12 weeks, and mortality of first-instar larvae was noted for six weeks. As mortality was high in the controls and irregular in all experimental series during the first week, the results had little absolute value. They showed, however, that the duration of effectiveness increased with the rate of application. Treatment at the lowest rate still gave considerable mortality of larvae in the first instar after 17 months, but not against those in the second and third instars after 12 months. At the highest rate, it was effective against larvae in all instars after 17 months, but more so against young than against old ones. These tendencies were more clearly reflected in larval weight than in mortality.

In further tests, soil that had been treated with BHC in 1950–52 was collected from the field in May 1953 and put in pots in September with first-instar larvae of *M. hippocastani* and *Anomala* (*Phyllopertha*) *horticola* (L.). The rate of application at the places from which the samples were taken was about 0·057 oz. γ BHC per sq. yard, and mortality was high in all the tests, though it decreased as the interval since the date of treatment increased. It is concluded that BHC applied against the older larvae will in practice remain effective against the young larvae of the next generation. Such treatment is usually applied at rates not exceeding 0·009 oz. γ BHC per sq. yard, and this would prove effective against the first-instar larvae if carried out during or after the spring of the year preceding the flight year, but BHC applied at higher rates to the holes in which plants are set would remain effective for two or even three years.

Völk (J.) & Bode (O.). **Weitere Untersuchungen zur Frage eines Zusammenhanges zwischen Düngung, Blattlausbesatz und Krankheitsausbreitung in Kartoffelbeständen. II. Mitteilung.** [Further Investigations on the Question of a Correlation between Fertiliser, Aphid Infestation and Spread of Disease in Potato Fields. Second Communication.]—*Z. PflKrankh.* **61** pt. 2 pp. 49–70, 10 figs., 13 refs. Ludwigsburg, 1954. (With a Summary in English.)

Applying potassium chloride as a fertiliser to potato plants has been shown to result in increased infection by leaf-roll virus, although the leaves of these plants are no more attractive to Aphids than others [*R.A.E.*, A **42** 183], and comparative field tests were carried out in Germany in 1950–51 with various fertilisers or none to discover whether this increase was due to higher infestation by Aphid vectors or to greater susceptibility of the plants to infection. The fertilisers used contained nitrogen alone, or potassium chloride, potassium sulphate or sodium chloride, each with nitrogen and phosphorus. Infestation was estimated by counting the numbers of Aphids per 100 leaves in June–July and also, in 1951, by means of yellow-coloured trap-dishes [*cf.* **41** 8, etc.]. The results are given in numerous graphs and tables and discussed mainly with respect to *Myzus persicae* (Sulz.) and

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Aphis (*Doralis*) *rhamni* Boy. None of the treatments caused infestation to deviate considerably from the average, and though the percentage of plants infected with leaf-roll was significantly higher for treatment with potassium chloride and sodium chloride than for the other treatments or none, infestation was not. Since potassium sulphate did not result in the same high infection rate as potassium chloride, it is concluded that plants fertilised with compounds containing chlorine are more susceptible to infection with the virus.

Lordello (L. G. E.) & Menezes Mariconi (F. A.). **Biologia da** *Arsenura xanthopus* **(Walker, 1855) (Lepidoptera-Adelocephalidae), praga do " Açoita-Cavalo "** (*Luehea* **spp.) e notas sôbre seus inimigos naturais.** [The Biology of *A. xanthopus*, a Pest of *Luehea* spp., and Notes on its natural Enemies.]—*Ann.* (*Anais*) *Esc. Agric. Queiroz* **10** pp. 189–216, 5 pls., 1 fig., 4 tables (2 fldg.), 16 refs. Piracicaba, 1953.

Much of the information in this account of observations on *Arsenura xanthopus* (Wlk.) infesting *Luehea* spp. in São Paulo and its control has already been noticed from a shorter version [*R.A.E.*, A **42** 325]. Laboratory investigations on its bionomics showed that the egg stage lasted at least a week, and larvae that hatched in the second half of February 1951 pupated in April. The pupae gave rise to adults between September and the following January, but a batch of pupae obtained in March 1953 had not done so by November of that year. Notes on the bionomics of the two effective parasites are included.

Ohnesorge (B.). **Der Einfluss von Geruchs- und Geschmacksstoffen auf die Wahl der Frasspflanzen beim grossen braunen Rüsselkäfer** *Hylobius abietis* **L.** [The Influence of Scent and Flavour on the Choice of Food-plants by *H. abietis*.]—*Beitr. Ent.* **3** no. 5 pp. 437–468, 9 graphs, 23 refs. Berlin, 1953.

The following is based on the author's summary of this account of laboratory experiments carried out in Germany on the substances that attract adults of *Hylobius abietis* (L.) and *H. pinastri* (Gylh.), which showed completely similar reactions, to their food-plants. Sap expressed from the bark and phloem of spruce and pine was attractive, and the attractants were at least in part soluble in ether. Sap from spruce needles was also attractive, but only slightly effective as a feeding stimulant, and the beetles soon left it for spruce-bark sap when this was also available. Pine-phloem sap was four times as attractive as that from spruce, and the latter was slightly more effective than that from silver fir [*Abies alba*], Douglas fir [*Pseudotsuga taxifolia*], larch and *Tsuga heterophylla*, which differed little among themselves. Sap from the bark of deciduous trees was much less attractive than that from conifers, and resins were repellent. In sugar solution, 0·5 per cent. acetaldehyde, acetone or acetic acid and 0·1 per cent. oxalic acid or formaldehyde were attractive, though less so than was pine-bark sap, but 0·5 per cent. formaldehyde was repellent.

The beetles distinguished between cane-sugar solutions of different concentrations, and reacted to far greater sugar dilutions than occur in plant sap. In tests with different sugars, attractiveness varied with the degree of sweetness, but lactose and saccharin were not preferred to water. It is concluded that the beetles are attracted to a source of food, and stimulated to feed, by scent, but that the duration and intensity of feeding are determined by flavour.

Francke-Grosmann (H.). **Über die Brutfürsorge einiger an Kulturweiden lebender triebstechender Rüssler (Curculionidae) und ihre phytopathologische Bedeutung.** [On the Provision for their Young of some Weevils (Curculionids) that puncture cultivated Willow Shoots, and its phytopathological Significance.]—*Beitr. Ent.* **3** no. 5 pp. 468–478, 4 figs., 15 refs. Berlin, 1953.

The shoots of basket willows in north-western Germany are injured by various weevils. *Curculio* (*Balanobius*) *salicivorus* Payk. and *C.* (*B.*) *crux* F. feed in early spring by puncturing the young shoots but cause negligible damage and oviposit only in the galls of *Pontania* spp. *Rhynchaenus stigma* (L.) and *R. salicis* (L.) oviposit in the shoots near the tip and sometimes cause wilting, but the wounds are usually healed by callus formation, so that infestation is not common. *Rhynchites* (*Merhynchites*) *tomentosus* Gylh., *R.* (*M.*) *longiceps* Thoms., and *R.* (*M.*) *nanus* (Payk.) lay their eggs in the terminal buds of the growing shoots and then cut or ring the latter, causing wilting, and *R.* (*M.*) *germanicus* Hbst. feeds in spring in the axils of the shoots, rings the tips so that they wilt and lays its eggs in chambers in the wilted portion.

Wellenstein (G.). **Zur Frage der Schutztauchung der Forstkulturen.** [On the Question of protective Immersion of Forest Plants.]—*Beitr. Ent.* **3** no. 5 pp. 488–503, 4 figs., 20 refs. Berlin, 1953.

Details are given of experiments in Germany in 1951–53 in which it was found that dipping the aerial parts of young spruce stock in proprietary preparations of DDT, BHC or both afforded protection against attack by *Hylobius* and *Hylastes* spp. and that immersing the roots protected young pine and spruce against Lamellicorn larvae, though there was some risk of damage when high concentrations were used. The treatments were shown to be highly economical.

Nolte (H. W.). **Beiträge zur Epidemiologie und Prognose des Rapserdflohs (*Psylliodes chrysocephala* L.).** [Contributions to the Epidemiology and Forecasts of the Abundance of *P. chrysocephala*.]—*Beitr. Ent.* **3** no. 5 pp. 518–529, 4 graphs, 20 refs. Berlin, 1953.

It had been considered that populations of *Psylliodes chrysocephala* (L.) on rape are limited principally by the occurrence of cold winters [*cf. R.A.E.*, A **31** 75, 372], but infestation in central Germany was light in the autumn of 1952, though the previous winter had been mild and a long cool spell in March had not caused any important reduction in numbers. It is considered that low temperatures between mid-August and mid-September hindered migration of the adults to rape fields and that this possibility should be considered in predicting the degree of infestation.

Petersen (G.). **Taxonomie und Verbreitung der Kornmotten (Lepidoptera: Tineidae).** [The Taxonomy and Distribution of the Grain Moths.]—*Beitr. Ent.* **3** no. 6 pp. 577–600, 3 pls., 3 figs., 22 refs. Berlin, 1953.

The four moths that form the subject of this paper are *Tinea granella* (L.), *T. infimella* H.-S., *T. cloacella* Haw. and *T. ruricolella* Stnt. The author accepts Corbet's conclusion that *T. secalella* Zacher is a synonym of *T. personella* Pierce & Metcalfe [*R.A.E.*, A **32** 187], though he considers that the serration of the gnathos is subject to individual variation and is not

a specific character. The shape of the sacculus, which was the character on which Zacher distinguished *T. secalella* from *T. personella* was found to vary with the method by which specimens were prepared and not to be a true differentiating character. He considers, however, that *T. infimella* is not an earlier name for *T. personella* [**31** 518], but a synonym of *T. cloacella*. Corbet based his view on the plate published by Herrich-Schäffer, in 1851, whereas the author's interpretation is based on Herrich-Schäffer's remark in the text, published in 1853, that he was using the name *infimella* for *cloacella* since the latter name had been applied by Wood to another species. Keys based on the genitalia are given to the males and females of *T. granella*, *T. infimella* (*personella*), *T. cloacella* and *T. ruricolella*, the characters used in identification are discussed, and the preparation of specimens is described.

All four species primarily attack fungi, lichens and rotting wood, but *T. granella* and *T. infimella* have become of importance as pests of stored grain in Europe [*cf.* **31** 281] and *T. cloacella* attacks the corks of bottles in cellars [*cf.* **35** 71] and occasionally damp grain. The distribution of these moths is not well known. Museum specimens examined by the author included *T. infimella* and *T. cloacella* from western Rumania and the coast of Yugoslavia, and the latter also from Bulgaria.

von Schöning (R.). **Biologisch-ökologische Untersuchungen an *Byturus tomentosus* Fabr. und *fumatus* Fabr.** [Biological and ecological Investigations on *B. urbanus* (Lind.) and *B. ochraceus* (Scriba).]—*Beitr. Ent.* **3** no. 6 pp. 627–652, 9 figs., 18 refs. Berlin, 1953.

Byturus urbanus (Lind.) (*tomentosus*, auct.) is an important pest of raspberries in Europe, but much of the damage caused by it has been attributed to *B. ochraceus* (Scriba) (*fumatus*, auct.), which was thought to resemble it biologically and is the only other indigenous species of the genus in Germany [*cf. R.A.E.*, A **31** 5]. Characters are given differentiating these two Byturids in all their stages, together with an account of observations on their bionomics near Kiel in 1951–52.

Adults of *B. urbanus* emerged in the first half of May and were more active than those of *B. ochraceus*, which appeared about 8–10 days later. Both species underwent a period of maturation feeding. Adults of *B. urbanus* attacked the buds and partly opened leaves of raspberry and occasionally the young leaves of blackberry. They fed principally on pollen, however, and were almost equally common in the flowers of blackberry and raspberry, sometimes numerous in those of hawthorn (*Crataegus oxyacantha*), and occasionally seen on the blossoms of apple, pear and strawberry. Adults of *B. ochraceus* were found only in open flowers, but the plants attacked were more numerous and included many weeds. They were commonest in summer on *Ranunculus repens* and *Geum urbanum* and were only occasionally observed on raspberry. The sexes were approximately equal in number in both species, and pairing occurred repeatedly, particularly before and at the beginning of the oviposition period. The eggs were laid in the flowers. *B. urbanus* oviposited only on raspberry and blackberry, preferring flowers in which the fruit was already set, and *B. ochraceus* only on *G. urbanum*. The first eggs were found in early June. *B. urbanus* oviposited regularly until mid-July, the rate of deposition averaging 2–3 eggs every 24 hours, and then sporadically, whereas *B. ochraceus* deposited one egg every 1–2 days for the first week and then, after a break of several days, 1–2 per week. The total number of eggs per female reached 100–120 for *B. urbanus* and 15–45 for *B. ochraceus*. Adults

of *B. urbanus* were present until early September in 1951, but those of *B. ochraceus* were not seen after 20th July.

The larvae of *B. urbanus* hatched in about eight days, occurred from June to October and fed in the raspberry fruits [*cf.* **19** 638], becoming full-fed in 35–45 days, when the raspberries were ripe. On blackberry, they lived mainly in the drupels, the fruits dried out, and the seeds, though not attacked, failed to ripen. Larvae of *B. ochraceus* hatched in about a fortnight, were present from late June to late August, and became full-fed in about 30–40 days. They consumed the seeds of *G. urbanum*, leaving the fleshy parts of the fruits intact. Both species overwintered in the larval and adult stages in the soil at depths of about 1–4 ins., though *B. urbanus* usually remained nearer the surface than did *B. ochraceus*. Most examples of the former overwintered as adults, and most of those of the latter as larvae, but some larvae of both species that had overwintered did not pupate until August and the resulting adults overwintered before leaving the soil [*cf.* **19** 638].

No parasites were reared from either species. Adults of both ceased feeding at temperatures below 16–18°C. [60·8–64·4°F.] but were undisturbed by rain unless it was heavy. They avoided strong sunshine, and *B. ochraceus* markedly preferred shaded situations. The effect of temperature and humidity on development is shown on graphs and discussed. *B. urbanus* was in general the more resistant to low temperatures, but the larvae succumbed more easily than did those of *B. ochraceus* at high temperatures. The distribution of the two species in Europe is discussed from the literature, and it is considered that records of *B. ochraceus* as a pest of raspberries are due to misidentification.

Nirula (K. K.), Antony (J.) & Menon (K. P. V.). **Investigations on the Pests of the Coconut Palm. (1) The Rhinoceros Beetle** (*Oryctes rhinoceros*). **Control of Grubs of** *Oryctes rhinoceros*.—*Indian Cocon. J.* **4** no. 1 pp. 5–12, 34–35, 16 refs. Ernakulam, 1950. **(2) Comparative Studies with different Insecticides in Relation to the Control of the Grubs of the Rhinoceros Beetle** (*Oryctes rhinoceros*, **L.**).—*T. c.* no. 2 pp. 49–56, 5 refs. 1951. **2. The Coconut Caterpillar** *Nephantis serinopa* **Meyr. Part I. Life History and Habits.**—*T. c.* no. 4 pp. 217–223, 1 pl., 13 refs. **Part II. Control with DDT Spray.**—*T. c.* pp. 225–234, 1 graph, 17 refs. **The Rhinoceros Beetle** (*Oryctes rhinoceros* **L.**). **Life History and Habits.**—*Op. cit.* **5** no. 2 pp. 57–70, 1 pl., 41 refs. 1952.

The last of these five papers on pests of coconut in India contains a review of the distribution and economic importance of *Oryctes rhinoceros* (L.), all stages of which are described, and an account of its bionomics on coconut based on the literature [*cf. R.A.E.*, A **28** 205] and observations in the laboratory and field. The adults remained in the crowns of the palms for 3–10 days, feeding on the sap from the unopened leaves and shoots in which they bored. Mature palms are rarely killed by the attack in India, though they may be weakened and rendered liable to infestation by the red palm weevil [*Rhyncophorus ferrugineus* (Ol.)]. The preferred breeding medium was cattle dung, and eggs were not laid in coir dust or in coconut husks that were mulched and buried or left to decompose in the open for over three months. The preoviposition period lasted 20–60 days, and the number of eggs deposited per female varied from 48 to 152. The larvae hatched in a week at a constant temperature of 90°F. and in 15 days out of doors at daily minimum and maximum temperatures of 72 and 87°F. The larval stage lasted 75–152 days, according to season, temperatures of

90–105°F. being optimal. Larvae two months old survived for 20 days when deprived of food, and those in coconut logs that were immersed in sea water or buried in the soil at a depth of 3 ft. survived for 48 hours and a fortnight, respectively. Cocoons were constructed in sandy soil at a depth of 4 ft. during the dry season and 1 ft. during the rains. The pupal stage lasted 14–30 days, and the adults remained in the cocoons for a further 10–30 days or more. No parasites of *O. rhinoceros* have been observed in India, but larvae in the laboratory were attacked by *Metarrhizium anisopliae* [*cf.* **28** 206], and a culture of this fungus destroyed healthy larvae.

The first paper contains an account of tests on the value of DDT and BHC against the larvae. In the laboratory, dusts and sprays of BHC were more effective, persistent and rapid in action against larvae in cow dung than dusts and sprays of DDT at similar dilutions, and field trials were therefore confined to the former. When the dust was mixed with heaps of cattle manure to give dilutions of 0·1 and 0·05 per cent. BHC in the manure and 50 larvae were subsequently introduced, all or virtually all were killed in 14 days, and the heaps were still free from infestation after three months, which is the maximum period for which they are generally left unused. In another test, small pits containing manure were sprayed with suspensions of BHC in water to give 0·1 per cent. BHC, and 100 larvae were subsequently introduced. Mortality reached 86 per cent. in four days and was complete in a further six days. When the surface of the manure in a pit from which 200 larvae had hitherto been collected every two months was dusted liberally with BHC, only seven larvae were found two months later. For general purposes, sprays are considered to be more satisfactory than dusts, since they penetrate the manure more easily.

The experiments described in the second paper were carried out to compare BHC, DDD, toxaphene and several arsenical insecticides for control of the larvae. In laboratory tests, sprays and dusts of the various materials were applied to cow dung in jars to give dilutions of 1, 0·5, 0·1, 0·05 and 0·01 per cent. toxicant, and mature larvae were subsequently introduced. A dust and a water suspension of BHC gave complete mortality in 4–6 days at all dilutions, all the larvae being moribund 48 hours after treatment. A toxaphene dust killed or paralysed all the larvae within 72 hours at the three highest concentrations and affected 85 per cent. of them at 0·05 per cent.; the lower concentrations were ineffective. DDD in a spray gave complete mortality (in 20 days) when the concentration in the manure was 1 per cent. and sodium arsenite in sprays gave complete mortality in one day at the three highest concentrations and in three days at 0·05 per cent. A dust of calcium arsenate and a spray of lead arsenate both gave complete mortality in 3–4 days at 1 and 0·5 per cent. and in six days at 0·1 per cent., and a spray of paris green gave complete mortality in eight and seven days at 1 and 0·5 per cent., respectively. In view of their toxicity to livestock and poultry, the use of arsenicals is not recommended. In another experiment, BHC was ineffective at dilutions of 0·005–0·0005 per cent. The persistence of its toxic effects was tested in the laboratory by introducing larvae every two months into farmyard manure that had received one insecticidal treatment. After six months, both dusts and sprays affording 0·01–1 per cent. BHC in the manure continued to give complete mortality of the larvae in about eight days. In a field trial with various breeding media, pits were sprayed with BHC and then filled with farmyard manure, cow dung, a 1:1 mixture of cow dung and decaying vegetable matter, or decaying vegetable matter including rotting coconut stems, which was sprayed to give concentrations of 0·1 or 0·01 per cent. BHC in the medium. In all cases, complete protection was given until the media were no longer attractive for oviposition. Cut coconut logs were protected by drenching the open ends with

0·01 per cent. BHC. On the basis of these results, the application of sprays of BHC to breeding materials in and round coconut gardens at a dilution of 0·01 per cent. BHC in the medium is recommended; this rate is sufficient to kill the larvae of *O. rhinoceros*, but not to repel ovipositing females.

In the third paper, the authors describe all stages and the distribution of *Nephantis serinopa* Meyr., which is an important pest of coconut in many parts of India, and give an account of its bionomics based on laboratory investigations. The females laid about 150 eggs each, on the lower surfaces of the leaves, and the egg, larval, prepupal and pupal stages lasted 3–7, about 40, about 2, and 10–14 days, respectively. The adults survived for 4–7 days. The larvae feed voraciously on the leaves, forming silken tunnels. Attack is usually confined to the lower, mature leaves, and severe defoliation, which is heaviest where the trees are close together, results in premature nutfall, the shedding of the flowers, and the cessation of spathe-production. Palms that were completely defoliated two or three times in succession did not succumb unless they were growing on poor soil or were attacked by other pests.

The fourth paper contains an account of experiments on the control of *N. serinopa* by means of DDT. In laboratory tests, mortality among third- and fourth-instar larvae that were placed on coconut fronds in pots and sprayed with 0·025–0·4 per cent. DDT three days later, when they had formed their shelters, reached 68 per cent. or more after treatment with 0·2–0·4 per cent. DDT, and there was further mortality among the pupae. Fully grown larvae tended to cease feeding and pupate early. The fertility and survival period of adults that completed their development were not affected. In a field experiment, infested palms 5–6 years old were sprayed with DDT at concentrations of 0·1–0·5 per cent. The lowest concentration gave 75 per cent. mortality of the larvae and pupae, and concentrations of 0·3, 0·4 and 0·5 per cent. killed 87, 88 and 90 per cent. of the larvae and 91, 94 and 96 per cent. of the pupae, respectively. Adults of the parasite, *Stomatoceras sulcatiscutellum* Gir., that emerged from pupae of *Nephantis* on the sprayed leaves appeared healthy. A field trial on a larger scale was begun in 1949 in a plantation in which infestation had been severe during 1947–49, the palms were stunted and largely defoliated, and all stages of *N. serinopa* were present together. A spray of 0·2 per cent. DDT applied in May 1949 reduced infestation by over 80 per cent. in a fortnight, few fresh infestations were noted after a second application in July, and a third in November gave complete control. The pupal parasites, *Trichospilus pupivora* Ferrière and *S. sulcatiscutellum*, and the prepupal parasite, *Elasmus nephantidis* Rohw., were not affected, and assisted in reducing infestation in the control block during December. A heavy infestation developed there during the hot months of 1950, but a protective application of 0·1 per cent. DDT to the experimental plots in November prevented their becoming reinfested during 1951. Since coconut palms are exposed to heavy showers and strong winds, a concentration of 0·2 per cent. DDT is recommended for controlling heavy infestations, though 0·1 per cent. is sufficient for preventive treatments.

Afzal (M.) & Ghani (M. A.). **Cotton Jassid in the Punjab.**—*Sci. Monogr. Pakistan Ass. Advanc. Sci.* no. 2, 10 × 7½ ins., viii + 102 pp., 6 pls. (3 col.), 78 refs. Lahore, 1953. Price *Rs.* 10.

Empoasca devastans Dist. is a serious pest of American varieties of cotton in the Punjab, and with increased cultivation of these varieties, preventive and protective measures became essential. Research was begun at Lyallpur in 1937 and carried on for eight years, and the results are here recorded.

Collection by means of a light-trap indicated that *E. devastans* is positively photokinetic and that the females are attracted to light in much greater numbers than the males; it is thought that use could be made of this behaviour in control. Three other Jassids, previously undescribed, were found attacking cotton in the Punjab [*cf. R.A.E.*, A **29** 265–266], but all were of minor importance [*cf.* **35** 31]. Detailed studies of the alternative food-plants of *E. devastans* showed that the most important, in order of decreasing attractiveness, were *Hibiscus esculentus*, *Althaea rosea*, egg-plant (*Solanum melongena*), potato, *Hibiscus mutabilis*, *H. tiliaceus*, *Helianthus annuus* and *Datura fastuosa* [*cf.* also **29** 516]. Among the American varieties of cotton grown on a large scale, four are highly resistant, while two are very susceptible. The *desi* varieties of cotton (*Gossypium arboreum*) are practically immune.

Mature leaves, 35–45 days old, are preferred for oviposition. Infestation begins at the end of June or the beginning of July, six weeks after sowing, reaches a peak in the latter half of August and practically disappears by the beginning of November. High atmospheric humidity was found to be the chief factor favouring the increase. The chief effect of attack is reduced boll production. At a farm where a susceptible variety was extensively grown, the yield in 1944, when Jassids were extremely abundant, was reduced to almost a quarter of that in 1942, when they were virtually absent. Under conditions of severe infestation, resistant varieties develop typical symptoms, but their yield and fibre properties were shown not to be adversely affected [*cf.* **32** 415]. Populations were found to increase with delay in sowing and with increased distance between plants and rows.

The nature of resistance was investigated in detail, and was found to depend on the ability of the females to deposit their eggs in the leaf veins, neither hatching nor the development of the nymphs being adversely affected on resistant varieties. Of the characters associated with resistance, but not necessarily causing it, the hairiness of the leaf vein appeared to be the most important [*cf.* **33** 386; **41** 407], and the use of hairy varieties is recommended where Jassid attack is severe.

Dun (G. S.). **Notes on Cacao Capsids in New Guinea.**—*Papua New Guinea agric. Gaz.* **8** no. 4 pp. 7–11. Port Moresby, 1954.

Of the four Mirids described by China & Carvalho from the Territory of Papua and New Guinea [*cf. R.A.E.*, A **40** 6], where plantings of cacao have recently been increased, *Parabryocoropsis checsmanae* is recorded from Papua, *P. duni* from the Gazelle Peninsula of New Britain and from Lae, New Guinea, and *P. typicus* and *Pseudodoniella pacifica* from the Gazelle Peninsula, New Britain. Only the last two are at present of economic importance. Both attack cacao, *Parabryocoropsis* being found at all levels and *Pseudodoniella* occurring in numbers only above 500 ft. In addition, *Helopeltis clavifer* (Wlk.) was recently taken on cacao in one new plantation in Papua. It is probably widespread on native plants but has not previously come into contact with an economic crop. The only other Bryocorine Mirid in the Territory is *Pachypeltis* sp., which occasionally damages the shoots of *Cinchona* at an altitude of 6,000 ft. in New Guinea.

Damage to cacao by the Mirids consists largely of mechanical injury to the pods caused by feeding, which causes the loss of many pods, each individual usually producing 40–80 feeding scars in 24 hours, and about as many pods are lost through attack by other insects and a fungus of the genus *Glocosporium* at the sites of Mirid injury. The degree of infestation varies considerably within small areas, but losses at the experiment station at Keravat, New Britain, where infestation by *Parabryocoropsis typicus* is

sometimes severe, amount to about 15–20 per cent. of the pods, and losses of up to 80 per cent. of the pods on the trees at one time have been reported.

P. typicus is difficult to rear in the laboratory, but observations indicated that the egg stage lasts 12–17 days, with an average of 14, and the five nymphal instars 1–2, 2–3, 2–3, 2–3 and 3–5 days, respectively. No large-scale control measures have yet been undertaken, but good control of *Pseudodoniella pacifica* was given by three applications of 0·2 per cent. DDT in an emulsion spray, and by BHC dusts. No parasites were obtained, but Reduviids of the genus *Pristhesanctus*, the ant, *Occophylla smaragdina* (F.) and an Attid spider were observed preying on *Parabryocoropsis typicus* and apparently afford considerable control.

Szent-Ivany (J. J. H.). **Two new Insect Pests of** *Theobroma cacao* **in New Guinea.**—*Papua New Guinea agric. J.* **9** no. 1 pp. 35–37, 8 refs. Port Moresby, 1954.

Adults of the Cassidid, *Aspidomorpha testudinaria* (Montr.), which was previously known as a minor pest of sweet potato, were found causing considerable damage to the leaves of cacao in two coastal plantations in the Madang district of north-eastern New Guinea in August–October 1954. The attack is thought to have resulted from severe defoliation of sweet potato in 1953–54 by larvae of *Herse convolvuli* (L.), the large populations of *A. testudinaria* that developed in these years being forced to seek alternative food.

The larvae of a small Limacodid, thought to represent a new genus and species, completely defoliated cacao interplanted with coconut in a block of about 100 acres, 70 miles from Madang, in November 1954. A spray of 2 per cent. DDT gave good control. Cocoons, which were found in batches of up to 15 at the ends of branches or in smaller groups or singly on damaged leaves, were removed to the laboratory and a few parasites, identified as *Brachumeria salomonis* (Cam.) and *Eurytoma albotibialis* Ashm., emerged from them. Many of the remainder did not give rise to adults, and it is thought that this may have been due to an effect of the DDT on the pupae and to weakening of the larvae through lack of food. Cocoons were also found on a coconut frond. The literature on Limacodids that attack cacao and coconut is briefly reviewed.

Lamb (K. P.). **Field Trials of five Swede Varieties with special Reference to Aphid Resistance.**—*N. Z. J. Sci. Tech.* **35** (A) no. 2 pp. 135–145, 3 figs., 8 refs. Wellington, N.Z., 1953.

The following is based on the author's summary. In field trials at Auckland and Ashburton, New Zealand, two widely grown varieties of swede supported significantly lower populations of Aphids than two others [*cf. R.A.E.*, A **42** 335]. *Brevicoryne brassicae* (L.) was the dominant species at both places, and small numbers of *Myzus persicae* (Sulz.) and *Rhopalosiphum pseudobrassicae* (Davis) were also present at Auckland. The first two varieties outyielded the latter two at Auckland and had a lower incidence of turnip mosaic, which is transmitted by Aphids, and soft rot.

In a trial in South Canterbury, a fifth variety supported significantly lower populations of *B. brassicae* and *M. persicae* than one of the first two and also produced larger roots. In addition, the proportion of alate to apterous Aphids on it was considerably higher.

Jacks (H.). **Seed Disinfection. VIII. Control of Weevil damaging French Beans and Maize Seed in Storage.**—*N.Z. J. Sci. Tech.* **35** (A) no. 2 pp. 159–163, 1 fig. Wellington, N.Z., 1953.

This paper is one of a series of which the earlier parts are not of entomological interest. It contains an account of experiments in New Zealand on the value of proprietary seed dressings in controlling infestation by *Bruchus* (*Acanthoscelides*) *obtectus* Say and *Calandra oryzae* (L.) in stored bean and maize seeds, in which the dusts investigated were Spergon (98 per cent. tetrachloro-p-benzoquinone), Spergon DDT (93 per cent. tetrachloro-p-benzoquinone with 3 per cent. DDT), Agrosan (1 per cent. tolyl mercury acetate) and Agrosan BHC (1 per cent. tolyl mercury acetate with 20 per cent. BHC). The dusts were mixed with the seeds, which were usually infested artificially after treatment, at a rate of 0·2 per cent. by weight of seed in a rotary machine, after which the seeds were stored in jars at 16–20°C. [60·8–68°F.] for 9–12 months. Sowings were made the day after treatment and subsequently at three-monthly intervals. In a test with french beans naturally infested with *B. obtectus*, the germination percentages a year after treatment with Agrosan BHC and Spergon DDT were 61 and 11·7, respectively, as compared with 0 for talc, the other two dusts conferring no protection, but in a test in which the beans were artificially infested, all four treatments resulted in improved germination, ranging from 40·2 to 59·3 per cent., with no significant difference between them. Agrosan applied to maize artificially infested with *C. oryzae* gave good protection for three months, when the percentage germination was 80·7, as compared with 30·5 for talc, but was useless thereafter, whereas Spergon, Agrosan BHC and particularly Spergon DDT were effective for nine months, when the experiment terminated, and the germination percentages were 23·4, 78·7 and 93·8, respectively, as compared with 0.

Jacks (H.) & Harrison (R. A.). **Control of Onion Thrips. II. Final Selection of Insecticides.**—*N.Z. J. Sci. Tech.* **35** (A) no. 2 pp. 164–167, 1 fig., 1 ref. Wellington, N.Z., 1953.

An account is given of experiments in New Zealand in 1952–53 in which insecticides and mixtures of insecticides similar to those tested in the previous year were applied in sprays against *Thrips tabaci* Lind. on onion [*cf. R.A.E.*, A **42** 50]. It is concluded that effective control is given by emulsified solutions containing 1 lb. p,p′DDT per 100 gals. applied at intervals of ten days from early November until 14 days before harvest.

Wise (K. A. J.). **Host Plants of *Lithocolletis messaniella* Zeller (Lepidoptera: Gracillariidae) in New Zealand.**—*N.Z. J. Sci. Tech.* **35** (A) no. 2 pp. 172–174, 4 figs., 1 ref. Wellington, N.Z., 1953.

Lithocolletis messaniella Zell., which is known to feed on oaks, sweet chestnut (*Castanea sativa*) and hornbeam (*Carpinus betulus*), was found in 1950 for the first time in New Zealand, where it has since caused some injury in the Hastings district. A list is given of the trees attacked. They include all the species of oak examined, a native beech (*Fagus*) and nursery stocks of *Feijoa sellowiana*.

Hinman (F. G.). **Screening Tests of Compounds as Fumigants for Eggs and Larvae of the Oriental Fruit Fly.**—*J. econ. Ent.* **47** no. 4 pp. 549–556, 4 refs. Menasha, Wis., 1954.

The following is based on the author's introduction and summary. Fresh fruits and vegetables liable to infestation by fruit-flies in Hawaii may be

transported to the mainland of the United States on condition that a satisfactory treatment to eliminate possible infestation has been applied, and 189 compounds were therefore tested at Honolulu as fumigants against naked eggs and third-instar larvae of *Dacus dorsalis* Hend. Those that killed 95 per cent. of both eggs and larvae at concentrations of less than 10 mg. per litre comprised 1-chloro-4-iodobutane, diiodomethane, 1-iodohexane, 1-iodoheptane, iodoethane, 3-iodopropene, iodocyclohexane, allyl ester of isothiocyanic acid, 1,4-dichloro-2-butene, epibromohydrin and 1,2-dibromobutane. The iodine compounds were the most toxic, and the first four of them were the only halogen compounds as toxic as ethylene dibromide [*cf. R.A.E.*, A **40** 74]. The compounds that gave 95 per cent. mortality of both eggs and larvae at dosages of 10–50 mg. per litre were α-bromotoluene, α-chloroxylene, bromocyclopentane, chlorocyclopentane, 1-bromo-3-chlorobutane, 1-bromo-3-chloropropane, 2-bromo-1-chloropropane, 1-iodo-2-methylpropane, 2-iodobutane, 1-iodo-3-methylbutane, crotoaldehyde and butylamine.

Singh (S. M.). **Studies on *Apsylla cistellata* Buckton causing Mango Galls in India.**—*J. econ. Ent.* **47** no. 4 pp. 563–564, 7 refs. Menasha, Wis., 1954.

Apsylla cistellata (Buckton) causes extensive losses of mangos in certain districts of Uttar Pradesh, India, every year. The nymphs of the Psyllid feed in the reproductive and vegetative buds, causing the formation of galls and reducing the amount of fruit set. Injury is commonest and most severe on grafted varieties, whereas saplings escape damage. Up to 16 nymphs occur per gall. The adults leave the galls by the last week of March, and the females oviposit in the veins of the new leaves in April, as many as 150 eggs being laid per female in a length of about four inches. The nymphs hatch by the third week of September and enter the adjacent buds. Males and females occur in equal numbers, and there is only one generation a year at Dehra Dun. Adults lived for up to 36 hours in the laboratory.

Spraying the trees at intervals of a fortnight from mid-February to the first week of May with 3 per cent. tar distillate, 3·75 per cent. BHC or 3 per cent. crude oil emulsion reduced the numbers of galls formed by 98·5, 85 and 75 per cent., respectively, and treatment of a heavily-infested tree bearing many eggs on the leaves with 3 per cent. tar distillate in September, before hatching, resulted in 80 per cent. reduction in galls, whereas a similar untreated tree showed 14·5 per cent. increase.

Hervey (G. E. R.) & Swenson (K. G.). **Effectiveness of DDT for Cabbage Caterpillar Control in western New York: 1944 and 1953.**—*J. econ. Ent.* **47** no. 4 pp. 564–567, 2 graphs, 9 refs. Menasha, Wis., 1954.

The following is substantially the authors' summary. Data are presented showing the degree of control of *Pieris rapae* (L.) and *Trichoplusia ni* (Hb.) on cabbage given by DDT dusts in western New York in 1944 and 1953, and the manner in which the effectiveness of DDT against both species steadily decreased during this period, until in 1953 its future adequacy was doubtful. This change was not due to seasonal or area variation, since the trend of decreasing effectiveness was quite consistent and DDT had proved highly effective against cabbage caterpillars in widely separated areas when it was first introduced [*cf. R.A.E.*, A **34** 319; **35** 253; **38** 66]. Though *P. rapae* was less susceptible to DDT in 1953 than in 1944, it is not considered to have developed resistance [*cf.* **41** 86], since four dust applications during

the season still afforded good control. *T. ni* appeared to have acquired a considerable degree of resistance, even four applications proving ineffective in 1953.

Wolcott (G. N.). **Dispersion to the Tropics of the Spirea Aphid.**—*J. econ. Ent.* **47** no. 4 pp. 568–571, 11 refs. Menasha, Wis., 1954.

Aphis spiraecola Patch, which appears to have been present in unimportant numbers on wild and cultivated *Spiraea* in the northern United States for many years, was found on *Citrus* in Florida in 1924 and Cuba and Porto Rico in 1926; its method of spread is unknown. In 1946, it was found to be the vector of a mosaic disease of papaya in Porto Rico [*cf. R.A.E.*, A **37** 33] and was so widespread there that prevention of infection in new papaya groves was impossible. Both the Aphid and the disease were subsequently found in Cuba and Florida, and the Aphid only in Jamaica and St. Thomas (Virgin Islands) [*cf.* **41** 145]. Eradication of all infected plants would appear to be the only practical method of preventing the extension of the disease.

In Porto Rico, colonies of *A. spiraecola* were found on the indigenous *Prunus occidentalis* and various other trees in 1953, indicating that the Aphid now attacks a variety of plants and may therefore become an even more serious pest than it is already.

In the western United States, *A. spiraecola* was collected on various plants in California in 1931, but has not become of importance on *Citrus* there, and spread slowly north, reaching Oregon and Washington by 1949–50. It was collected on *Citrus* in Honduras in 1928 and Costa Rica in 1933, so that it is presumably widely dispersed in Central America and may invade South America [*cf.* **42** 173].

Munson (S. C.), Padilla (G. M.) & Weissmann (M. L.). **Insect Lipids and Insecticidal Action.**—*J. econ. Ent.* **47** no. 4 pp. 578–587, 1 graph, 26 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. The hypothesis that insect lipids affect the action of an insecticide such as DDT by competing for it with the site of toxic action [*R.A.E.*, B **42** 71] is discussed in the light of pertinent literature. It is shown to explain negative coefficients of toxic action with temperature [*cf.* A **40** 345, etc.] as well as the preconditioning effects of different temperatures, and it clarifies the relation between the liposolubility and insecticidal action of compounds such as DDT analogues, several of which are highly liposoluble and have low-grade insecticidal properties. It may also throw light on the differences in resistance to a given insecticide of insects of different nutritional conditions, sexes and stages of development, and on seasonal, specific and possibly strain variations in resistance, though it does not account for all such variations.

The amounts of DDT and p,p′methoxy-DDT (methoxychlor) that remain in solution for about an hour in the total lipids of *Periplaneta americana* (L.) at different temperatures when supersaturated solutions are cooled were established and are shown on a graph; there was a steep rise for both compounds between 20 and 30°C. [68–86°F.], which is in accordance with the hypothesis, for it is generally at this critical range that negative temperature coefficients occur. When nymphs of *P. americana* were preconditioned at different temperatures and treated externally with chlordane, bromo-DDT and fluoro-DDT, their resistance varied in the same way as to DDT [*cf.* B

42 71]; chlordane was more toxic and bromo-DDT and fluoro-DDT progressively less toxic than DDT. Although females were more resistant than males to the DDT analogues, there was no clear difference between sexes in resistance to chlordane. Adults of *Drosophila melanogaster* Mg. and *Oryzaephilus surinamensis* (L.) preconditioned at different temperatures also varied in their resistance to DDT applied externally, the mean survival times at 23°C. [73·4°F.] being shorter for those preconditioned at 30°C. than for those preconditioned at 18°C. [64·4°F.] or 23°C. Chlordane, methoxy-DDT, fluoro-DDT and bromo-DDT showed negative coefficients of action with post-treatment temperature when tested against *Oryzaephilus*.

Benjamin (D. M.) & Drooz (A. T.). **Parasites affecting the Jack-pine Budworm in Michigan.**—*J. econ. Ent.* **47** no. 4 pp. 588–591, 9 refs. Menasha, Wis., 1954.

Choristoneura pinus Freeman [*cf. R.A.E.*, A **42** 219–220] has caused widespread destruction of jack pine [*Pinus banksiana*] throughout the Lake States periodically since 1923, and investigations on its parasites were begun during outbreaks in the lower peninsula of Michigan in 1951–53. Examination of eggs, overwintering and mature larvae, and pupae showed that *Trichogramma minutum* Ril. was the only egg parasite present; that *Apanteles fumiferanae* Vier. and *Glypta fumiferanae* (Vier.) parasitised the overwintering second-instar larvae, the former being the more abundant; that the mature larvae were parasitised by *Lypha setifacies* (West.), *Actia interrupta* Curr., *Agria affinis* (Fall.) and *Zenillia* (*Phryxe*) *pecosensis* (Tns.), of which the first was the commonest; and that the pupae were parasitised mainly by *Itoplectis conquisitor* (Say), and also by *A. affinis*, *Amblymerus verditer* (Nort.), *Apechthis ontario* (Cress.), *Phaeogenes hariolus* (Cress.), *Ephialtes* (*Scambus*) *hispae* (Harris), a species of *Syntomosphyrum* near *csurus* (Ril.), *Exochus* sp., *Habrocytus* sp. (probably a secondary parasite) and unidentified Diptera, all of which appeared to be of negligible importance.

Populations of *C. pinus* in the forests studied reached a peak in 1951 and then declined markedly. Defoliation was of medium intensity in all stands of *P. banksiana* in 1951, light in 1952 and absent or light in 1953. Populations were essentially the same in all areas. Comparison of the parasites obtained with those recorded from Ontario [**42** 220] and with those of the spruce budworm, *C. fumiferana* (Clem.) in New England [*cf.* **41** 207, etc.] and of a form of this species that attacks Douglas fir [*Pseudotsuga taxifolia*] in Colorado [*cf.* **37** 431] indicated that some of the more important are widely distributed on several hosts. Of these, *I. conquisitor* and *Apanteles fumiferanae*, which attack all three forms mentioned, appear to afford important control.

Gerhardt (P. D.). **Argentine Ant Control with Sprays and Bait in two California Lemon Groves.**—*J. econ. Ent.* **47** no. 4 pp. 591–593, 5 refs. Menasha, Wis., 1954.

The following is based on the author's summary. In view of the effectiveness of sprays in controlling *Iridomyrmex humilis* (Mayr) in *Citrus* groves in California [*cf. R.A.E.*, A **42** 295], they were compared with poison baits in replicated blocks of lemon trees in two groves in Santa Barbara County in 1951–52. When poisoned-bait cups containing 1 oz. 0·3 per cent. sodium arsenite were put under heavily infested trees, they did not reduce infestation until two months later, whereas one application of a spray of

2 lb. chlordane, dieldrin or heptachlor per 100 U.S. gals. water, applied to the trunk, to branches that touched the ground and to litter beneath the trees controlled the ant within a shorter period and remained effective for at least six months. Dieldrin proved superior to chlordane or heptachlor. During the 11 months of the experiment, the poisoned-bait cups had to be replaced on an average three times per tree, and more time and labour were involved in servicing and maintaining them than were required to apply the sprays. At the end of the experiment, 55·5 per cent. of the trees in the poisoned-bait plots were infested, as compared with 8·5, 37·5 and 24·7 per cent. of those in the plots sprayed with dieldrin, chlordane and heptachlor.

Harvey (T. L.). **Chemical Control of a Spider Mite on Wheat in eastern New Mexico.**—*J. econ. Ent.* **47** no. 4 pp. 593–597, 3 figs., 4 refs. Menasha, Wis., 1954.

Paratetranychus pratensis (Banks) appeared to be the most injurious pest of wheat in eastern New Mexico in 1952–53 and was present on the plants from the time of the first survey in September until the crop was mature in July. It occurred in small colonies on the leaves in autumn, in the crown of the plants near the soil in winter and in the upper leaves and heads from May onwards. Plants in the laboratory that were heavily infested with the mite when they reached the two-leaf stage died within three weeks. Tests of chemical control were carried out in April–June 1953, the mites being separated from plant samples by centrifuging and then counted. Of the 14 compounds tested, all in emulsion sprays, Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate] at 0·5–1 lb. and parathion at 1–2 lb. actual compound per acre consistently gave the best control (75 per cent. or more) [*cf. R.A.E.*, A **42** 309], whereas 1·3–2·7 lb. Chlorobenzilate (ethyl 4,4′-dichlorobenzilate) gave erratic results and 9·6 lb. Compound 923 [2,4-dichlorophenyl benzenesulphonate], 4 lb. R-242 [p-chlorophenyl phenyl sulphone), 3·2 lb. Ovotran [p-chlorophenyl p-chlorobenzenesulphonate], 3 lb. malathion, 1·1 lb. DMC [1,1-bis(p-chlorophenyl)ethanol] and 1 lb. EPN [ethyl p-nitrophenyl thionobenzenephosphonate], methyl-parathion, Metacide [methyl-parathion and parathion], dieldrin, schradan and Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] per acre gave less than 75 per cent. control. Mite populations became significantly higher in the plots treated with dieldrin than in untreated ones, possibly because the toxicant destroyed the predacious thrips, *Scolothrips sexmaculatus* (Perg.), while having little if any effect on the mites.

Hastings (E.) & Cowan (T. E.). **Seed Treatment of Fall planted Wheat for Wireworm Control.**—*J. econ. Ent.* **47** no. 4 pp. 597–599, 1 fig. Menasha, Wis., 1954.

Areas in central Montana in which wheat had for several years died from unknown causes during the winter were found to be infested by wireworms, which were numerous enough to be responsible for the injury. Most of those examined were probably *Athous* sp. Experiments on their control were carried out in 1951, when six-acre plots in two fields were sown on 19th September with seed, some of which had been treated with a slurry of Mergamma (a mixture of 40 per cent. γ BHC and 2 per cent. phenyl mercury urea) and some with a fungicide only. Germination and growth were rapid, and observations in the first week of November and on 14th April showed no differences in plant cover between treatments. On 12th May, many dead plants and living wireworms were found in the plots of

wheat receiving no insecticide, whereas dead wireworms were numerous where the seed had been treated with 2·25 and 2·5 oz. Mergamma per bushel, and a few occurred near plants treated at 1·75 and 2 oz. per bushel. On 2nd June, there were almost twice as many plants in the insecticide-treated plots as in the others in one of the fields, and comparisons of yield showed that in both fields the seed treated with insecticide produced more grain per acre than untreated seed in adjoining plots. Yield increases due to wireworm control varied from 0·4 to 8·6 bushels per acre, 2·25 oz. Mergamma per bushel of seed apparently giving the greatest protection for the cost involved.

Ditman (L. P.), Rosenberger (C. R.) & Harrison (F. P.). **Spraying for Control of Bean Insects.**—*J. econ. Ent.* **47** no. 4 pp. 600–603, 2 figs., 2 refs. Menasha, Wis., 1954.

Preliminary experiments with CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] and malathion for the control of insects attacking snap and lima beans in Maryland in 1952 showed that the former gave slightly the better control of the Mexican bean beetle [*Epilachna varivestis* Muls.] and resulted in slightly higher yields than did malathion in the absence of the beetle, that 1·5 U.S. pints 50 per cent. malathion emulsion concentrate per acre gave better yields when applied in 20, 30 or 40 U.S. gals. water than in 55 or 80 U.S. gals. and that neither material gave satisfactory control of the corn earworm [*Heliothis armigera* (Hb.)] on lima beans. The potato leafhopper [*Empoasca fabae* (Harris)] was the most prevalent pest, and yield increases are attributed in part to its control.

Further tests were made in 1953, when all insecticides were applied in 25 U.S. gals. water per acre. In the first, snap beans were sown in late May, sprayed with 2 U.S. pints 50 per cent. malathion or 25 per cent. CS-708 emulsion concentrate per acre on 5th, 10th and 18th June and 2nd and 13th July and harvested on 10th and 15th July. *Epilachna varivestis* was present in moderate numbers, in addition to *Empoasca fabae*, the bean leaf beetle [*Cerotoma trifurcata* (Forst.)] and the spotted cucumber beetle [*Diabrotica undecimpunctata howardi* Barber]. The two compounds increased the yield per plot from 19·9 to 34·8 and 33·5 lb., decreased the percentage of plants injured by *Epilachna* from 54 to 9·2 and 1·5 and decreased the percentage of pods injured by insects from 4 to 1·6 and 2, respectively. In others, five weekly applications of 1·5 and 2 U.S. pints 50 per cent. malathion and the same quantities of 25 per cent. CS-708 to snap beans lightly infested with *Empoasca* increased the yield per plot from 166·6 to 177·2, 186·6, 192·1 and 191·5 lb., respectively, and eight weekly applications of 2 U.S. pints malathion and CS-708 concentrates per acre to lima beans increased the yield from 55 to 86·9 and 65 lb. shelled beans per plot. In the last, only the plants sprayed with malathion retained their foliage until harvest. Differences in yield were caused by a heavy infestation of the two-spotted spider mite [*Tetranychus bimaculatus* Harvey], against which CS-708 is apparently not effective. Injury by *Epilachna* was negligible.

Tests of concentrates containing 25 per cent. DDT for the control of *H. armigera* were made on late lima beans, all of which received two applications of 2 U.S. pints 25 per cent. CS-708 on 4th and 27th August and two of 2 U.S. pints 50 per cent. malathion per acre on 11th August and 10th September against other pests. Treatments against *Heliothis* were begun on 20th August, and beans were harvested on 15th and 23rd September. Four weekly applications of 1, 2, 3 or 4 U.S. pints DDT concentrate

per acre by a machine having three nozzles per row resulted in 42·8, 57·1, 42·8 and 78·5 per cent. reduction in pod injury, respectively, and three of 2 U.S. pints at ten-day intervals in 50 per cent., commercial control not being obtained. Heavy applications of the DDT concentrate caused no apparent foliage injury or reduction in yield.

Four-row spray booms with three nozzles per row were used by growers to treat snap beans with 2 U.S. pints CS-708 concentrate per acre when the first pods began to form and with this or the malathion concentrate at the same rate two weeks later, and excellent control of *Epilachna*, *Empoasca* and thrips was obtained. A similar machine with five nozzles per row was used to apply 2–3 U.S. pints 30 per cent. DDT concentrate per acre for the control of *Heliothis* on late lima beans and appeared to be satisfactory, resulting in no such loss of quality as occurred in untreated beans in the vicinity.

It is concluded that alternate sprays of CS-708 and malathion give good control of all pests but *Heliothis*, particularly on lima beans.

King (K. M.) & Forbes (A. R.). **Control of Root Maggots in Rutabagas.** —*J. econ. Ent.* **47** no. 4 pp. 607–615, 9 refs. Menasha, Wis., 1954.

The following is based on the authors' introduction and summary. *Hylemyia* spp. cause severe injury to table-grade swedes in many parts of British Columbia, and investigations on their control were carried out on Vancouver Island in 1948–52. The chief species present was *H. brassicae* (Bch.); *H. floralis* (Fall.) also occurred in considerable numbers in August–September and secondary species of the complex of *H. cilicrura* (Rond.) and *H. trichodactyla* (Rond.) were found in variable numbers. The results showed that, for good control, it was necessary to maintain adequate amounts of insecticide near the roots throughout the period of growth, and the band method, by which the insecticide is applied in a narrow band and lightly covered with soil, after which the crop is sown along the middle, proved very suitable. Spray applications to the crop, soon after it comes up and again as late in the growing period as is feasible, were also effective and may become one of the most practical methods where suitable equipment is available. Application in the planting furrow with the seed was usually effective but involves a greater risk of phytotoxicity, and dust applications to the growing crop were generally ineffective or unreliable. Aldrin and heptachlor were the two most effective insecticides tested and gave satisfactory control when applied to rows 3 ft. apart by the band, furrow and spray methods at 5, 2·5 and 5 lb. per acre, respectively, for aldrin, and 5, 2·5 and 3 lb. per acre for heptachlor in loam soils of average organic content. Dieldrin, though effective, did not show sufficient advantage over aldrin to warrant its use, chlordane, even at high rates, did not give adequate commercial control, BHC was effective only at rates that were impracticable because of the risk of affecting flavour, and DDT, lindane (almost pure γ BHC) and parathion showed no promise.

Richardson (B. H.). **Control of Onion Thrips in the Winter Garden in 1953.**—*J. econ. Ent.* **47** no. 4 pp. 616–618, 5 refs. Menasha, Wis., 1954.

In further tests of organic insecticides for the control of the onion thrips [*Thrips tabaci* Lind.] on onion in the Winter Garden area of Texas [*cf. R.A.E.*, A **41** 267], carried out in 1953, dusts of 5 per cent. heptachlor or CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis-(p-chlorophenyl)-2-nitrobutane], 2·5 per cent. dieldrin or aldrin and mixtures

of 3 per cent. γ BHC, 5 per cent. DDT and 40 per cent. sulphur and of 1 per cent. γ BHC and 5 per cent. DDT, applied at 15–22 lb. per acre, gave satisfactory control after one day, heptachlor, dieldrin and the first mixture were still more effective and CS-708 as effective after eight days, and heptachlor and dieldrin were still extremely effective after 20 days. Several phosphate dusts applied at the same rates gave excellent results after one day, 5 per cent. malathion being the best, followed by 1 per cent. methyl-parathion, 2 and 1 per cent. parathion, 1 per cent. Metacide [methyl-parathion and parathion], and 5 per cent. EPN [ethyl p-nitrophenyl thiono-benzenephosphonate] in order of decreasing effectiveness. Eight days after treatment, 2 per cent. parathion and 1 per cent. methyl-parathion gave the best and 1 per cent. Metacide the least control, and EPN and 2 per cent. parathion still gave fair results after 16 days.

When a spray of 0·5 lb. heptachlor in 40 U.S. gals. water per acre was applied 3–7 times, three applications at intervals of seven days were much less effective than five or seven at intervals of seven days, three or five at intervals of 14 days, or three at intervals of 21 days, but all gave commercial control. It is probable that treatments made at 21-day intervals would prove sufficient.

Tashiro (H.) & Fleming (W. E.). **A Trap for European Chafer Surveys.** —*J. econ. Ent.* **47** no. 4 pp. 618–623, 2 figs. Menasha, Wis., 1954.

The following is substantially the authors' summary. *Amphimallon majalis* (Razoum.) has spread over a continuous area of 550 sq. miles in western New York in the past 12 years. Surveys for it outside the known infested area are carried out, and progress made in developing a trap for the adults is summarised.

Java citronella oil was more attractive as a bait than six of its components, and mixtures of it or of lemon oil with eugenol were very attractive. Lemon oil was too volatile for practical use, however, and a mixture of Java citronella oil with eugenol (3:1 by volume) was selected as the best. Virgin males and females in traps were not particularly attractive to adults of either sex.

The colour of the trap influenced the numbers of beetles captured. White was the least attractive colour, and black and reds the most attractive; chinese red was tentatively selected as the best. Traps with a glossy finish were more effective than those with a dull finish. The effectiveness of traps was proportional to their size. Greasing the baffles increased the capture, but was impracticable for large-scale operations. Some evidence was obtained that catches might be increased by covering the baffles with a large-mesh wire screen. A trap should be placed away from tall trees and silhouetted against the sky. When near small trees or shrubs, it should be on their leeward side.

In 1952, 365 traps were set out on the periphery of the infested area, and beetles were captured at distances up to 3·7 miles beyond the known infestation. In 1953, the infestation was similarly shown to have extended for 2·7 miles beyond its previous limits along the north-western edge.

English (L. L.) & Decker (G. C.). **Spray Mixtures to control Putnam Scale and Bark Beetles on Elms.**—*J. econ. Ent.* **47** no. 4 pp. 624–627, 11 refs. Menasha, Wis., 1954.

General and, in some cases, severe injury by *Diaspidiotus* (*Aspidiotus*) *ancylus* (Putn.) to elms in the grounds of the University of Illinois in the

spring of 1952 was believed to be a result of treatment with two DDT sprays a year from 1949 onwards, for the control of *Scaphoideus luteolus* Van D., the vector of phloem necrosis of elm, and a survey of trees that were unsprayed or had received totals of 2, 4 or 6 sprays showed an almost linear correlation between the number of applications and infestation ratings.

During the summer of 1952, malathion, NPD (tetra-n-propyl dithiono-pyrophosphate) and cubé powder (5 per cent. rotenone), added to DDT sprays, gave no control of the scale. In 1953, an increase in the incidence of Dutch elm disease necessitated a pre-foliar application of DDT for control of the bark-beetles that disseminate the causal fungus (*Ceratostomella ulmi*), and experiments were carried out to determine whether the scale could be controlled with mist-blower applications of dormant oil and whether DDT emulsion concentrates could be mixed with the dormant oil to control both scale and bark-beetles in one treatment by hydraulic sprayer or mist blower without reducing the effectiveness of either or injuring the trees. Two proprietary DDT formulations mixed with 4 per cent. dormant oil (Dendrol) to give 2 per cent. DDT and applied with a hydraulic sprayer gave very good kills of *D. ancylus*, with no significant difference between them. A hydraulic application of 4 per cent. dormant oil alone was less effective when followed in two weeks by a hydraulic application of 2 per cent. DDT than when followed by a mist-blower application of 12 per cent. DDT. On plots treated with the mist blower only, 12 per cent. DDT alone caused no significant increase in kill over no treatment, and there was no significant difference between treatment with 24 per cent. dormant oil alone or mixed with 6 or 12 per cent. DDT or 12 per cent. dormant oil with 6 per cent. DDT, all of which gave good control; mixing 3 per cent. DDT in a wettable powder with dormant oil gave inferior results. The mortality (91 per cent.) produced by natural agents on a plot that had not been sprayed for two years was almost identical with that from 24 per cent. dormant oil.

When adults of *Scolytus multistriatus* (Marsham) were confined with twigs from the test trees, the numbers of feeding scars were significantly less on all sprayed twigs than on untreated ones, and there was no essential difference between the numbers of feeding scars on twigs from trees sprayed with dormant oil mixed with 6 and 12 per cent. DDT. DDT residues were much greater from DDT alone than from a mixture of DDT and oil in mist-blower application but not in hydraulic application. There was little difference between residues when the mixtures of DDT and oil were applied by the two methods.

WARREN (L. O.). **Teosinte as a Host for Stored Grain Insects.**—*J. econ. Ent.* **47** no. 4 pp. 630–632, 3 refs. Menasha, Wis., 1954.

The following is based on the author's summary. Teosinte (*Euchlaena* sp.) has many potential uses, and since little was known of the susceptibility of the seeds to stored-grain pests, husked and unhusked seeds were exposed to infestation by *Calandra* (*Sitophilus*) *oryzae* (L.), *C.* (*S.*) *granaria* (L.), *Rhizopertha dominica* (F.) and *Sitotroga cerealella* (Ol.), and husked seeds to *Lacmophlocus* sp., *Oryzaephilus surinamensis* (L.), *Tribolium castaneum* (Hbst.) and *T. confusum* Duv.

Of the external feeders, *T. castaneum* was least successful in reproducing on teosinte, and the other species varied from a low production of progeny by *Laemophlocus* to a fairly high production by *O. surinamensis*. All the internal feeders developed continuously on husked teosinte, but only *S. cerealella* survived on the unhusked seeds. Husked seeds left in an open container became infested by *Plodia interpunctella* (Hb.).

Gyrisco (G. G.), Hopkins (L.), Muka (A. A.) & Burrage (R. H.). **Improved Baits for the Control of the Alfalfa Snout Beetle.**—*J. econ. Ent.* **47** no. 4 pp. 636–641, 3 refs. Menasha, Wis., 1954.

As the standard bait of 100 lb. groundnut shells, 20 lb. sugar, 18 lb. soy-bean flour, 8 lb. sodium fluosilicate, 1 U.S. pint formalin and 12 U.S. gals. water rapidly loses its effectiveness against *Otiorrhynchus* (*Brachyrrhinus*) *ligustici* (L.) in lucerne fields in New York, particularly in very wet or dry weather [*cf. R.A.E.*, A **29** 252], the effectiveness of chlorinated hydrocarbons as a substitute for the fluosilicate was tested in 1950–53. The following is based on the authors' summary of the results. The substitution of 1–2 oz. aldrin, dieldrin, chlordane, heptachlor, isodrin or endrin for 8 lb. sodium fluosilicate per acre in the bait resulted in good control for periods of a month or more. No retreatment of the treated area was necessary, and even lower dosages might have been effective. Storing, drying or periodically wetting and drying the mixed baits did not reduce their effectiveness, though the speed of kill seemed to be reduced in some instances. The weevils were rapidly affected by all the compounds, and though they remained moribund for as long as a week, none was observed to recover.

Zimmack (H. L.), Arbuthnot (K. D.) & Brindley (T. A.). **Distribution of the European Corn Borer Parasite** *Perezia pyraustae*, **and its Effect on the Host.**—*J. econ. Ent.* **47** no. 4 pp. 641–645, 3 refs. Menasha, Wis., 1954.

The following is substantially the authors' summary. In 1952, *Perezia pyraustae* [*cf. R.A.E.*, A **41** 114] was found infecting *Pyrausta nubilalis* (Hb.) on maize in ten counties in Illinois, 38 in Iowa, two in Michigan, 23 in Minnesota, three in Ohio, nine in South Dakota and five in Wisconsin. In studies of this parasite in Iowa, uninfected female moths laid only *Perezia*-free eggs whether or not their mates were infected. Diseased moths usually laid infected eggs, and they had shorter lives and laid fewer eggs than uninfected ones. It was therefore concluded that this microsporidian is transmitted through the egg. Infection was induced in the laboratory when viable eggs were dipped in a spore suspension and when spores were smeared on the food of the larvae. Survival was lower and growth slower among infected than among uninfected larvae, whether they came from diseased moths or were artificially infected. No pupae were obtained from diseased larvae in the laboratory. A preliminary field test showed higher proportions of diseased larvae in hills of maize sprayed with spore suspensions than in untreated ones, but the results were not conclusive.

Mistric jr. (W. J.) & Gaines (J. C.). **Effect of Weather Factors on the Toxicity of certain Insecticides.**—*J. econ. Ent.* **47** no. 4 pp. 646–651, 7 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Experiments were carried out at College Station, Texas, in 1953 to obtain additional information on the effect of wind on the toxicity of certain insecticides to insects on cotton [*cf. R.A.E.*, A **41** 362]. Laboratory cage tests with emulsion sprays of toxaphene, dieldrin and endrin against *Anthonomus grandis* Boh. and of these materials and aldrin against *Estigmene acraea* (Dru.) showed similar results for both insects. The toxicity of toxaphene decreased more than that of the other materials in the presence of simulated wind but less than that of the others in its absence, and wind therefore appears to be the most

important climatic factor affecting the toxicity of toxaphene. Aldrin lost toxicity very rapidly even in the absence of wind. Both dieldrin and endrin were reduced appreciably in toxicity by simulated wind, both the immediate and the residual toxicities of endrin being slightly superior to those of dieldrin. Within the range tested, an increase in wind velocity resulted in a greater decrease in the toxicity of insecticides, and the effect of wind was not dependent on the dosage of insecticides applied.

Lilly (J. H.). **Insecticidal Control of the Corn Rootworm in 1953.**—*J. econ. Ent.* **47** no. 4 pp. 651–658, 1 fig., 1 ref. Menasha, Wis., 1954.

Investigations on the control of *Diabrotica longicornis* (Say) on maize in Iowa [*cf. R.A.E.*, A **41** 351] were continued in 1953. In a long-term experiment, aldrin, heptachlor, dieldrin and chlordane sprayed broadcast over ploughed land at 5 lb. per acre and disked in on 30th April 1952 resulted in significantly fewer lodged plants and significantly higher yields than no treatment in both 1952 and 1953. In the latter year, five methods of insecticide application not previously tested were investigated. Good commercial control of severe infestations and large increases in yield were obtained in fields that received broadcast applications of 1 lb. heptachlor, endrin, γ BHC or aldrin in 10 U.S. gals. water per acre, applied to the soil and maize stalks remaining from 1952 and disked in before ploughing and sowing. Significant reductions in rootworm numbers and in lodged plants were obtained in maize sown with a two-row lister when sowing was preceded by broadcast sprays of 1 lb. γ BHC, heptachlor or aldrin per acre and disking, and the application of low-gallonage sprays of 1 lb. heptachlor, endrin, isodrin, aldrin or chlordane per acre in six-inch bands over the planted rows and harrowing in across the rows, three days after sowing, gave good commercial control. Similar results were also obtained on ridge-sown maize when 1 lb. aldrin per acre was applied with a planter-mounted sprayer, sprayed in ten-inch bands on the ridges and worked in with a roller, or sprayed broadcast on ploughed soil before ridging and sowing, and on maize sown on flat soil treated by the first method. Treatment with 0·67, 1·34 or 1·91 lb. aldrin per acre in concentrated sprays applied by aeroplane (1–3 flights over each swathe) as the seedlings were beginning to emerge, followed by rotary-hoeing, gave promising results.

In the same year, aldrin, heptachlor or chlordane formulated on 30–60 mesh granulated Attaclay and mixed with starter fertiliser gave commercial control of a light infestation when applied at 0·5–0·8 lb. insecticide per acre in a band along the rows, but they were less effective than anticipated, and similar mixtures with side-dress fertilisers applied when the maize was about 1 ft. high were ineffective [*cf. loc. cit.*].

English (L. L.) & Tinker (M. E.). **The Effect of DDT Sprays on Mite and Aphid Populations on Elms.**—*J. econ. Ent.* **47** no. 4 pp. 658–660, 4 graphs, 9 refs. Menasha, Wis., 1954.

In the late summer of 1951, elm trees in Illinois that had been treated with two foliage sprays of 6 per cent. DDT a year from a mist blower since 1949 [*cf. R.A.E.*, A **43** 241] showed mite damage, and in 1952 and 1953, populations of *Tetranychus bimaculatus* Harvey and the Aphid, *Myzocallis* (*Tuberculatus*) *ulmifolii* (Monell), were compared on trees that were sprayed or left untreated in these two years.

Trees that were sprayed with DDT on 27th May and 24th July 1952 and with DDT supplemented with 6 lb. 15 per cent. wettable Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] per 50 U.S. gals. on

10th June 1953 had maximum populations of 67 mites per leaf on 15th August in the first year and 34 per leaf at the end of July in the second; untreated trees had maximum populations of 9–12 per leaf at the end of July and zero populations by about 26th August in both years. Less than 40 per cent. of the mites on the sprayed trees were dead in late August 1952, as compared with 97 per cent. on the unsprayed ones, and it seemed evident that the difference was due to a predator. The Coccinellid, *Stethorus punctum* (Lec.), was rarely observed, possibly owing to the method of collecting the leaves for sampling, but the predacious mite, *Typhlodromus fallacis* (Garman), was present on unsprayed leaves in both years and absent, or virtually so, from sprayed ones. The Aphid was more numerous on sprayed than on unsprayed trees in both years, the infestation on the former being somewhat irregular.

Simeone (J. B.). **Termite Danger Zones in New York State and their Use in Termite Prevention.**—*J. econ. Ent.* **47** no. 4 pp. 661–663, 1 map, 12 refs. Menasha, Wis., 1954.

Since New York State lies only partly within the northern limit of distribution of *Reticulitermes flavipes* (Kollar) [*cf. R.A.E.*, A **24** 494], it is suggested that four zones of relative termite hazard should be distinguished there, based on the incidence of termite damage. Lists are given of the localities in which the termites have been collected or suspected, and zones of high hazard (in which nearly every structure is in danger of attack), of moderate hazard (in which termites are abundant only in small localised areas), of low hazard (in which no termites have been collected in spite of proximity to the second zone and similarity of climatic conditions), and of no hazard (where the climate is unfavourable) are defined. A table is given in which recommendations for protection against termites in the first three zones are summarised.

Whitehead (F. E.). **Tests on insecticidal Control of Rice Water Weevil.**—*J. econ. Ent.* **47** no. 4 pp. 676–680, 1 graph, 3 refs. Menasha, Wis., 1954.

Since the draining and reflooding of rice-fields in Arkansas for the control of *Lissorhoptrus oryzophilus* Kuschel (*simplex*, auct.) [*cf. R.A.E.*, A **20** 415] results in the production of large populations of the mosquitos, *Psorophora confinnis* (Lynch Arrib.) and *P. discolor* (Coq.), tests on the control of the weevil by means of insecticides, which would eliminate drainage, were carried out in 1952 in fields that were sown on 14th May and flooded on 5th June. Dieldrin and lindane [almost pure γ BHC] were applied at 2·5 or 0·5 lb. per acre in bentonite granules [*cf.* **43** 14] placed in the soil just above the rice seed by means of a fertiliser attachment to the drill, or in sprays to the surface of the soil immediately after the rows were drilled and at 1 or 0·25 lb. per acre in the same granules or sprays applied over the soil surface just before the first flooding. Counts of the weevil larvae on 26th June and 3rd and 11th July indicated that application immediately before flooding was in general more effective than application at the time of sowing, that materials incorporated in the granules were less effective when buried in the ground than when scattered on the surface, and that dieldrin was the more effective insecticide, giving excellent control when applied at the rate of 0·25 lb. per acre just before flooding either in a spray or in granules.

In 1953, when weevil infestation was light, various insecticides were applied in sprays and in bentonite granules scattered by hand on the dry soil,

which was flooded the same day; the plants were about six inches high at the time. There were no significant differences in effectiveness between sprays and granules, and 8 oz. aldrin or heptachlor, 2 oz. dieldrin and 16 oz. chlordane per acre all gave at least 95 per cent. control of the larvae, and 4 oz. aldrin and 8 oz. chlordane 90–95 per cent. In further tests, counts of larvae between 7th July and 14th August showed that there were less than five per plant on plots that were treated with 4 oz. dieldrin per acre, flooded immediately and kept continuously flooded until drained for harvest, about 50–120 on plots flooded continuously, and about 50–150 before draining and 20–50 after it on plots that were flooded, drained at the proper time for control of the weevil, allowed to dry and reflooded after 15 days. Yields were about 49 bushels per acre in the first two cases and 44 in the third. Since there was no serious root injury on the plots that were drained and reflooded, the low yield from them is attributed to the depressing effects of drainage.

It is concluded that the use of insecticides promises to result in more effective and less expensive control of the weevil. It also saves water, which is scarce, and prevents the increase of mosquitos, the numbers of mosquito larvae in undrained plots being less than 1 per cent. of those in plots that were drained and reflooded.

Glick (P. A.) & Lattimore jr. (W. B.). **The Relation of Insecticides to Insect Populations in Cotton Fields.**—*J. econ. Ent.* **47** no. 4 pp. 681–684, 4 refs. Menasha, Wis., 1954.

In the course of large-scale experiments on the control of insects attacking cotton in Texas in 1949, studies were made of the effects of treatment with toxaphene, alone or with sulphur, or with DDT in mixtures with various combinations of BHC, chlordane, toxaphene or sulphur on the total insect population on the plants. Both sprays and dusts were applied, and it was found that although each treatment reduced injurious species, most of them also reduced predacious ones [*cf. R.A.E.*, A **43** 220]. Toxaphene was less destructive of predators than BHC or chlordane, and the addition of DDT to it increased toxicity to them. A dust of toxaphene and sulphur applied on 23rd July after two early-season sprays of toxaphene and DDT resulted in the lowest population of injurious insects and the highest population of beneficial ones, and in general, early applications permitted a greater survival or increase of beneficial forms than later ones. Notes on some of the species observed are included.

Mostafa Kamal Ahmed, Newsom (L. D.), Roussel (J. S.) & Emerson (R. B.). **Translocation of Systox in the Cotton Plant.**—*J. econ. Ent.* **47** no. 4 pp. 684–691, 9 figs., 3 refs. Menasha, Wis., 1954.

Since little is known as to the plant tissues involved in the translocation of Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate [demeton]), investigations were made on cotton in the laboratory. Systox was diluted 1:800 and applied by the cut-petiole technique to growing cotton plants infested by *Aphis gossypii* Glov., Systox prepared with radioactive sulphur (S^{35}) being used in some series, and translocation was assessed from changes in Aphid numbers or the radioactivity shown by various plant parts. In some tests, the plants were cut so as to isolate particular tissues. The results, which are given in detail, showed that Systox was translocated in the xylem tissue only. It moved both up and down the plant simultaneously, but movement towards the growing point was rapid and that in a downward

direction much slower. Seeds from plants treated at flowering with radioactive Systox showed a gradual decline in the amount of radioactivity 14, 21 and 28 days after treatment and a slight unexplained increase in it 35 days after. The same gradual decrease in radioactivity was observed when samples of the boll and bur alone were analysed. There was an inverse correlation between the age of the bolls at treatment and the amount of radioactivity at the time of analysis, indicating that the material is accumulated in the more rapidly growing young tissues.

Burkhardt (C. C.). **Chemical Control of the Western Corn Rootworm in Kansas in 1953.**—*J. econ. Ent.* **47** no. 4 pp. 691–696, 6 refs. Menasha, Wis., 1954.

The following is based on the author's introduction and summary. *Diabrotica virgifera* Lec. was the most important insect pest of maize in many parts of northern Kansas in 1953 [*cf. R.A.E.*, A **42** 289]. It can be controlled by crop rotation, but the removal of a field from maize production for one year only is not always effective [*cf.* **20** 412], and tests of insecticides were therefore begun in 1953. Materials were applied as emulsifiable concentrates in sprays or as wettable powders mixed with starter fertilisers; a 20 per cent. aldrin dust concentrate was tested in one field. Chlordane at 1·5 lb. and BHC at 0·5 lb. γ isomer per acre, sprayed over the surface of the soil before sowing and immediately ploughed in to a depth of about seven inches, which was excessive, gave poor results, and the efficiency of this method of application seems questionable in an area in which virtually all maize is sown with a lister.

In band treatments, with sprays applied from a lister-mounted sprayer with nozzles just behind the planter shoes and in front of the corn disks and press wheels, or with the fertiliser mixtures applied with a fertiliser attachment at sowing time, aldrin, heptachlor and lindane [almost pure γ BHC] at 0·25 or 0·5 lb. actual toxicant and chlordane at 0·5–1 lb. per acre gave great reductions in larval counts and numbers of lodged plants, with no important differences between the higher and lower rates of application or between the two methods of treatment. In one area, in which aldrin was applied at 0·5, chlordane at 0·75 and heptachlor at 0·5 lb. per acre, the numbers of larvae per plant and the percentages of lodged plants averaged 76 and 29 in untreated plots and 2, 14 and 1, and 1, 0 and 0, in the treated ones, respectively, and yields from the treated plots were almost twice those from the untreated ones. In another, the development of larvae that survived in plots treated with the four insecticides was found to be significantly retarded. The aldrin dust was applied in a fertiliser mixture at 0·5 lb. toxicant per acre and gave good results, though *D. virgifera* was not the dominant species present.

Fullaway (D. T.). **Biological Control of Cactus in Hawaii.**—*J. econ. Ent.* **47** no. 4 pp. 696–700. Menasha, Wis., 1954.

The tree cactus, *Opuntia megacantha*, has spread alarmingly in the Hawaiian Islands in the past 50 years and has invaded large grazing areas at the lower altitudes on Hawaii. Attempts to control it there were begun in 1943, and the introduction of insects that feed on it was undertaken in 1949. Of the several species introduced from various countries, *Dactylopius opuntiae* Ckll. and *Cactoblastis cactorum* (Berg) from Australia became established, and the latter proved outstandingly successful. It has two generations a year, and is not seriously hampered by natural enemies, though

some eggs are destroyed by predacious ants and *Trichogramma minutum* Ril. On one ranch on which both insects were liberated, so many large cactus plants were destroyed that the land is now suitable for resowing. *Lagochirus funestus* Thoms. from Australia was also released and appeared likely to become established, though its increase may be slower than that of the other two.

Messenger (A. P.). **Organization of a Plant Quarantine System in Okinawa.**—*J. econ. Ent.* **47** no. 4 pp. 703–704. Menasha, Wis., 1954.

Surveys made in connection with post-war agricultural rehabilitation on Okinawa showed that sweet potato was attacked by two introduced pests, *Euscepes postfasciatus* (Fairm.), which had appeared since the war, and *Cylas formicarius elegantulus* (Summers), which had been present before it. As sweet potato forms the chief native food supply, the establishment of a plant-pest control and quarantine organisation to protect this and other crops was considered desirable, and the measures taken are briefly described.

Menke (H. F.). **Indications of *Lygus* Resistance to DDT in Washington.** —*J. econ. Ent.* **47** no. 4 pp. 704–705, 2 refs. Menasha, Wis., 1954.

In central Washington, where *Lygus elisus* Van D., *L. hesperus* Knight, and *L. desertus* Knight are pests of lucerne grown for seed [*cf. R.A.E.*, A **42** 17], the first dust applications of DDT against them in 1952 and 1953 gave adequate control, but where additional later ones were required, these did not. In 1952, when temperatures were sometimes high, a dust containing 5 per cent. DDT and 3 per cent. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] and one containing 10 per cent. DDT alone, applied at 35 and 25 lb. per acre, respectively, both proved unsatisfactory; one containing 10 per cent. toxaphene and 4 per cent. Aramite was more effective, but less so than the first application of 10 per cent. DDT. In 1953, when temperatures were normal, a dust of 10 per cent. DDT and 1–2 per cent. parathion with or without sulphur, applied at 30 lb. per acre by aeroplane, was sometimes effective and sometimes not, and aeroplane applications of 2 lb. miscible DDT and 0·25 lb. parathion and of 3 lb. DDT and 10 oz. parathion in 5 U.S. gals. spray per acre gave very poor and good control, respectively. A 15 per cent. toxaphene dust applied at 30 lb. per acre gave excellent initial control, but was not always effective after two weeks. Mirids collected in fields in which control was poor were mainly *L. hesperus*, which may therefore be developing a greater resistance to DDT than the other species.

Lindgren (D. L.), Krohne (H. E.) & Vincent (L. E.). **Malathion and Chlorthion for Control of Insects infesting stored Grain.**—*J. econ. Ent.* **47** no. 4 pp. 705–706. Menasha, Wis., 1954.

In tests of the protection of stored grain by malathion and chlorthion (O,O-dimethyl O-3-chloro-4-nitrophenyl thiophosphate), whole wheat was treated with dusts or sprays, and infested with adults of *Calandra* (*Sitophilus*) *granaria* (L.), *C.* (*S.*) *oryzae* (L.) and *Rhizopertha dominica* (F.) immediately and at monthly intervals. The insects were removed after ten days and examined for mortality. Malathion was rather more effective and persistent in dusts than in sprays, and gave complete mortality of all three species after one and three months at 2 and 4 parts per million, respectively, in dusts and was still effective at 8–16 p.p.m. after 6–7 months.

Although oviposition was not prevented, there was no evidence of breeding four months after treatments that gave complete mortality of adults. *R. dominica* appeared to be the most and *C. oryzae* the least resistant of the three insects. Chlorthion in dusts incorporated in wheat killed 100 per cent. of *C. granaria* and *C. oryzae* and 93 per cent. of *R. dominica* when used at 4 p.p.m. and 77, 100 and 45 per cent., respectively, at 2 p.p.m.

Wilbur (D. A.). **Effect of certain Protectants on Germination of Wheat.** —*J. econ. Ent.* **47** no. 4 pp. 706–707. Menasha, Wis., 1954.

Wheat of two varieties with stable germination properties and one with weaker germination characteristics was treated with different insecticidal dusts and stored under various combinations of environmental conditions, to determine the effect of treatments on germination. The dusts consisted of 1·1 per cent. piperonyl butoxide and 0·08 per cent. pyrethrins impregnated in pulverised wheat (Pyrenone Wheat Protectant), 1·7 per cent. piperonyl butoxide and 0·17 per cent. allethrin or 1·4 per cent. piperonyl butoxide, 0·04 per cent. pyrethrins and 0·085 per cent. allethrin on pulverised wheat, and 1·1 per cent. piperonyl butoxide and 0·08 per cent. pyrethrins in a mixture of pulverised wheat and maize-cob flour (1:1). They were applied at 200–800 lb. per 1,000 bushels grain and caused no measurable differences in germination in wheat of 11–14 per cent. moisture content stored at temperatures of 40–100°F. for 15–45 days.

Polivka (J. B.). **Control of Japanese Beetle Larvae with Isodrin and Endrin.**—*J. econ. Ent.* **47** no. 4 p. 707. Menasha, Wis., 1954.

In a test of isodrin and endrin for the control of larvae of the Japanese beetle [*Popillia japonica* Newm.], begun in Ohio in 1952, 18·5 per cent. emulsifiable concentrates were diluted with water and applied to turf on 8th August. Treatment was followed by sufficient rain to disperse the insecticides in the soil, and on 22nd September, when the plots were sampled for larvae, 8·5, 1·2, 0 and 0·2 per sq. ft. were found on plots treated with 1, 5, 10 and 20 lb. technical isodrin per acre and 7, 1·3, 0 and 0 on those treated with the same quantities of endrin, as compared with 21·8 and 25·5 for no treatment. A year later, there were no grubs in any plot but the one that received isodrin at 1 lb. per acre and the two untreated ones, which had 0·5, 22·5 and 20·8 per sq. ft., respectively. The lower numbers for both compounds in the second year may have been due to greater effectiveness against newly hatched larvae.

Arbuthnot (K. D.) & Walton (R. R.). **Insecticides for Control of the Southwestern Corn Borer.**—*J. econ. Ent.* **47** no. 4 pp. 707–708, 4 refs. Menasha, Wis., 1954.

In tests in 1953 of insecticides against *Diatraea grandiosella* Dyar on maize in Oklahoma [*cf. R.A.E.*, A **32** 348], field maize sown in May was treated four times at weekly intervals beginning on 29th June, four days after eggs of the second generation were found, when the plants were 3–4 ft. tall and none had tasselled; 45 per cent. of the plants showed evidence of infestation by the first generation. Concentrated sprays were directed to two sides and the top of each plant, and dusts and granular formulations downwards to the top of each. Examination on 6th–7th August showed that 1 lb. endrin or lindane [almost pure γ BHC] and 2 lb. EPN

[ethyl p-nitrophenyl thionobenzenephosphonate] per acre in sprays gave complete or almost complete control of the second generation, 1 lb. aldrin and 6 lb. toxaphene in sprays, 9·6 lb. toxaphene in a dust and 0·9 lb. parathion in granules 93–95 per cent., and 13·2 lb. toxaphene and 1 lb. aldrin in granules and 1·2 lb. methyl-parathion, 1·1 lb. lindane and 1·2 lb. aldrin in dusts 72–88 per cent.; 1·2 lb. dieldrin per acre in a dust gave only 58 per cent. control. Populations were still much lower in plots sprayed with endrin, EPN and lindane than in other plots on 14th September, and the numbers of plants girdled were exceptionally low. In plots receiving the other treatments, populations and numbers of girdled plants at harvest were not much lower than in untreated plots. Although the best treatments gave excellent control, the high dosages and number of applications used render further investigations desirable.

Walker (R. L.) & Meymarian (A.). **Host Plants of the Spiny Bollworm in Iraq.**—*J. econ. Ent.* **47** no. 4 pp. 708–709, 3 refs. Menasha, Wis., 1954.

Investigations in Iraq showed that all stages of *Earias insulana* (Boisd.) were present in the field on one or more of its food-plants from April 1952 to April 1953, there being no true hibernation. The plants infested and the months during which they were attacked are shown in a list. Hollyhock (*Althaea rosea*) was the only one infested during late winter and early spring, before cotton and okra (*Hibiscus esculentus*) became available, but it is probable that other malvaceous plants may also serve as hosts during that period [*cf. R.A.E.*, A **41** 219].

Riherd (P. T.). **Thrips a limiting Factor in Grass-seed Production.**—*J. econ. Ent.* **47** no. 4 pp. 709–710, 6 refs. Menasha, Wis., 1954.

The seeds of Rhodes grass [*Chloris gayana*] produced in southern Texas often show a low percentage of germination, and in 1953, when the percentage was very low and seed heads were cut and dried in paper bags, numerous examples of the thrips, *Chirothrips mexicanus* Crwf., were recovered from them [*cf. R.A.E.*, A **38** 256]. No thrips were found by casual observation of the plants or by tapping the heads, but they were visible under magnification on the developing seeds. Observations showed that the heads were infested at flowering, all stages being found within the inflorescences; and the thrips fed on the ovaries and later on the developing seeds. For control, infested heads were cut off to reduce reinfestation, and a dust containing 10 per cent. DDT and 2·5 per cent. dieldrin was applied four times at weekly intervals at the rate of 30 lb. per acre. Subsequent examination of heads from treated and untreated areas showed that the average number of thrips per head was reduced from 85·5 to 2·7 and the percentage of seeds injured from 91·7 to 12·3.

Watts (J. G.) & Hatcher (J. B.). **White Grub Damage to young Pine Plantations.**—*J. econ. Ent.* **47** no. 4 pp. 710–711, 3 refs. Menasha, Wis., 1954.

Larvae of *Lachnosterna* (*Phyllophaga*) *prununculina* (Burm.) caused severe damage to young pine plantations in South Carolina in 1953. Seedlings of loblolly, slash and longleaf pines [*Pinus taeda*, *P. elliottii* and *P. palustris*] had been planted on 10,500 acres of unused land in the winter of 1952–53, and though the percentage survival was 88–96 in May, it fell

to 69, 80 and 72, respectively, in August, as a result of damage to the roots, and to less than 40 over an area of 2,750 acres in early November, when another 5,400 acres showed severe injury and 2,000 acres a certain amount. Soil samples taken in November–February showed populations of up to three larvae per sq. ft., with an average of rather less than one per sq. ft. Larvae of the first and second seasons were present, but the latter were the more numerous, and it was feared that spring feeding by third-year larvae would prove extremely harmful to trees already damaged. The larvae feed on the roots in the top 6–8 ins. of soil, and *P. taeda*, being shallow-rooted, was more seriously damaged than the other two. Similar injury was found in other plantings of pine in the coastal plain and in natural reproduction of *P. taeda*.

Howe (W. L.) & Miller (L. I.). **Effects of Demeton Soil Drenches on Peanut Pests.**—*J. econ. Ent.* **47** no. 4 pp. 711–712. Menasha, Wis., 1954.

In a test of the systemic insecticide, demeton [diethyl 2-(ethylmercapto) ethyl thiophosphate], for the control of insects and the root-knot nematode *Meloidogyne hapla* infesting groundnuts in Virginia in 1951, drenches were applied at rates to give 1, 2·1, 4·2, 8·4 and 16·8 lb. toxicant per acre along furrows 3 ins. deep, and immediately mixed with the soil to a depth of six inches, five days before sowing. The results showed that doses of at least 4·2, 1 and 2·1 lb. demeton gave significant reductions of *Franklinicella fusca* (Hinds), *Empoasca fabae* (Harris) and the nematode, respectively, but that only the highest dosage gave effective control. Injury by *Diabrotica undecimpunctata howardi* Barber, which attacks the pods in the soil, was significantly reduced by treatment with 4·2 lb. per acre, but 16·8 lb. gave only 72 per cent. control. There were no significant differences in yield. Demeton caused some injury to the seedling plants, increasing in severity with the rate of application.

King (D. R.). **Control of** *Acrobasis caryae* **and** *Tetranychus hicoriae* **on Pecans.**—*J. econ. Ent.* **47** no. 4 pp. 713–715, 1 graph, 5 refs. Menasha, Wis., 1954.

Experiments were carried out in Texas in 1953 to determine the most effective insecticide for the control of the first-generation larvae of *Acrobasis caryae* Grote on pecan before they enter the developing nuts. Suspension sprays were applied with a hydraulic sprayer on 22nd May, seven days after the first eggs were observed on the tips of the nuts, and counts of nuts on 11th June, when pupation was complete, showed that DDT and p,p′methoxy-DDT (methoxychlor) at 1·5 lb. and parathion and EPN [ethyl p-nitrophenyl thionobenzenephosphonate] at 0·25 lb. per 100 U.S. gals. reduced the average percentage of nuts destroyed from 63·7 to 12·7–20·5, with no significant difference between them, whereas dieldrin at 0·25 lb. per 100 U.S. gals. reduced it to 33·1.

The same materials, with the exception of methoxy-DDT, were also tested against an infestation that destroyed 48·5 per cent. of the nuts on untreated trees, and reduced it by an average of 97·2 per cent. As attack by the first generation was severe, half the trees in these plots were treated again with the same materials at the same rates on 5th June against the second generation. Examination on 8th August showed that single applications of DDT, parathion, EPN and dieldrin against the first generation resulted in 12, 20, 7 and 13 per cent. nuts destroyed and one against

each generation in 0·5, 1, 4 and 4·3 per cent., as compared with 21·2 per cent. destroyed on unsprayed trees. Infestation by *Tetranychus hicoriae* McG. developed after the treatment with DDT. Sprays containing 1 lb. 25 per cent. wettable parathion or 6 lb. wettable sulphur per 100 U.S. gals., applied on 27th July, gave satisfactory control of this mite for three weeks, whereas 1 lb. Sulphenone [p-chlorophenyl phenyl sulphone] or 0·25 lb. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] per 100 U.S. gals. emulsion spray was less effective. Marked increases in mite population occurred seven weeks after spraying.

Munger (F.) & Broadbent (B. M.). **2,4-D prolongs Life of experimental Lemons on the Henderson Rearing Racks.**—*J. econ. Ent.* **47** no. 4 p. 715, 3 refs. Menasha, Wis., 1954.

Lemons with the stem clipped close to the fruit and placed in moist sand have been used for rearing *Aonidiella aurantii* (Mask.) for laboratory spray tests in California [*cf. R.A.E.*, A **41** 214]. The stems usually separate from the lemons before tests lasting much more than 75 days are complete, and spoilage sometimes begins where the stem has been attached. To test the effect of 2,4-D [2,4-dichlorophenoxyacetic acid] in keeping the fruit in good condition, green lemons were washed in tap water, dipped in 3 per cent. sodium tetraborate at 90°F. for one minute and set on bottles with their stems in water, as usual. On the next day, some were dipped for two minutes in 2,4-D at 1:800 or 1:1,600 and others left untreated. Lemons of the three groups lasted for a minimum of 77, 204 and 68 days and an average of 218, 258 and 170 days, respectively, in the usual racks, and 15, 16 and 0 out of 16 retained their stems until discarded. When lemons were infested with crawlers of *A. aurantii* on the day after treatment with the weaker solution of 2,4-D, there was no reduction in settling, and development and reproduction were normal. The treatment has been adopted as standard procedure in preparing lemons for infestation.

Johansen (C. A.). **Bee Poisoning versus Pea Aphid Control in Alfalfa grown for Seed.**—*J. econ. Ent.* **47** no. 4 pp. 715–717, 3 refs. Menasha, Wis., 1954.

Macrosiphum pisum (Harris) (*pisi* (Kalt.)) becomes abundant on lucerne in flower in the Yakima Valley of Washington, and treatments applied for its control are often hazardous to honey bees. The direct toxicity to the latter of insecticides applied against the Aphid was measured by exposing two cages of 50–100 bees to each dust or spray when it was applied in the field, and the toxicity of residues by caging bees with bunches of lucerne flowers cut at intervals after treatment.

Dusts appeared to be more harmful to the bees than sprays. Of the former, 4 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] or malathion and 1 per cent. parathion were highly toxic, and 1 or 5 per cent. CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] very much less so; only Diazinon had much effect on the day after treatment. Toxaphene was relatively harmless. TEPP [tetraethyl pyrophosphate] was highly toxic when applied in the evening, at 74°F., but not in the morning, at 65°F.; it had no residual effects. Of the sprays, which were applied by aeroplane, Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)] at 0·5 lb. and CS-708 and Q-137 [ethyl-DDD (1,1-di(p-ethylphenyl)-2,2-dichloroethane)] at 1 lb. toxicant per acre caused little or no mortality, but malathion at 1 lb. was somewhat more toxic. Systox is apparently absorbed

by the plants so rapidly that it presents no hazard to bees if applied when they are not foraging. Carbolic acid and creosote were somewhat repellent to bees when used at 1 oz. and 1 U.S. pint, respectively, with 2 U.S. pints 25 per cent. parathion per acre and did not affect toxicity to Aphids or damage the plants seriously.

Johnson (P. C.). **A Feeding Record of the Ten-lined June Beetle.**—*J. econ. Ent.* **47** no. 4 pp. 717–718, 1 fig. Menasha, Wis., 1954.

Adults of *Polyphylla decemlineata* (Say) were observed feeding in considerable numbers on the needles of ponderosa pine [*Pinus ponderosa*] at Spokane, Washington, in July 1948 and 1949. More than half the needles in the terminal clusters of lateral branches appeared to be eaten, but not more than one Melolonthid was found per cluster. None of the trees, which were growing vigorously, was killed, and the damage from partial defoliation was not serious.

Lewallen (L. L.). **Greenhouse Rearing of the Soft Scale for Laboratory Screening Tests.**—*J. econ. Ent.* **47** no. 4 p. 718, 2 refs. Menasha, Wis., 1954.

Coccus hesperidum L. is usually controlled by parasites on *Citrus* in California, but it sometimes becomes numerous in groves treated with parathion, which has little effect on the scale but destroys the parasites concerned [*cf. R.A.E.*, A **39** 392, etc.]. With a view to testing alternative insecticides, attempts were made to rear the scale in the laboratory. Fruits, cuttings and six-inch seedlings of Valencia orange or lemon, and also grapefruits, proved unsatisfactory for rearing, but 12-inch Valencia-orange seedlings 12–13 months old at the time of infestation, were suitable. In the method adopted, crawlers from citron melons are gently brushed on to the stems and lower surfaces of the leaves of the seedlings, and these are kept in a dark room at about 80°F. and 75 per cent. relative humidity for two days and then in a greenhouse at about 80°F. and 65 per cent. relative humidity; under these conditions, the life-cycle from crawler to crawler lasts 39–40 days. Parasitism in the greenhouse can be reduced by aerosol sprays of parathion applied once a week.

Guagliumi (P.). **El escarabajo rinoceronte o " coco " *Podischnus agenor* (Oliv.) plaga de la caña de azúcar en Venezuela.** [The Rhinoceros Beetle, *P. agenor*, a Pest of Sugar-cane in Venezuela.]—*Bol. téc. Inst. nac. Agric. Venez.* no. 8, 42 pp., 9 pls., 20 refs. Maracay, 1954. (With a Summary in English.)

This second edition of a bulletin already noticed [*R.A.E.*, A **42** 272] resembles the first, but the distribution of *Podischnus agenor* (Ol.) on sugar-cane in Venezuela is shown to have been wider in 1953 than previously and infestation more severe.

Leiderman (L.). **Novos resultados com inseticidas no combate à lagarta das espigas de milho *Heliothis obsoleta* (Fabr. 1793).** [New Results with Insecticides for the Control of the Maize Earworm, *H. armigera* (Hb.).]—*Biológico* **20** no. 8 pp. 131–137, 2 refs. São Paulo, 1954.

Experiments on the control of *Heliothis armigera* (Hb.) (*obsoleta* (F.)) on sweet maize in Brazil [*cf. R.A.E.*, A **42** 324] were continued in 1953–54,

when sprays of DDT, endrin, isodrin, chlordane, parathion, dieldrin, aldrin, methoxy-DDT (methoxychlor), BHC, lindane [almost pure γ BHC] and toxaphene were applied against the larvae, and nicotine sulphate, Sulphenone [p-chlorophenyl phenylsulphone], Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], DN-111 [dinex (dicyclohexylamine)], EPN-300 [ethyl p-nitrophenyl thionobenzenephosphate], Metacide [parathion and methyl-parathion], and Ovotran [p-chlorophenyl p-chlorobenzenesulphonate] against the eggs. The former were applied four times and the latter five times at intervals of three days beginning when 10 per cent. of the silks had appeared, and the results were assessed 15 days after the last application.

When the insecticides were applied without the addition of a miscible white oil (Citrol), only 0·75 per cent. DDT proved satisfactory, reducing the percentage of ears attacked from 68·7 to 12·5. Sprays of 0·75 per cent. DDT, 0·1 per cent. endrin and 0·75 per cent. toxaphene with the addition of 5 per cent. Citrol reduced the percentage of ears infested from 86·2 to 3·7, 7·5 and 6·2, respectively, and 0·6 per cent. DDT and 0·08 per cent. endrin with 5 per cent. Citrol reduced it from 66·2 to 1·2 and 8·7. With 10 per cent. Citrol, 0·75 per cent. DDT and 0·1 per cent. endrin reduced the percentage from 98·7 to 3·7 and 7·5, respectively. Lower concentrations of these materials gave inferior results, as also did the other products tested, the ovicides proving ineffective with or without Citrol.

When wettable powders were compared with emulsion sprays, all with the addition of 5 per cent. Citrol, the percentages of ears attacked in the case of the emulsions and (in brackets) the wettable powders were 6·2 (5) for 0·4 per cent. DDT, 23·7 (20) for 0·06 per cent. dieldrin, and 31·2 (27·5) for 0·06 per cent. aldrin, as compared with 26·2 for 5 per cent. Citrol alone and 93·7 for no treatment. In a similar test with reduced concentrations, the percentages were 15 (22·5) for 0·3 per cent. DDT, 33·7 (25) for 0·05 per cent. dieldrin and 40 (30) for 0·05 per cent. aldrin, as compared with 20 for 5 per cent. Citrol alone and 83·7 for no treatment. In neither test was there a significant difference between wettable-powder and emulsion sprays of a given product.

Proceedings of the Jubilee Meeting [of the Association of Applied Biologists] **held in London 13–17 September 1954.**—*Ann. appl. Biol.* **42** pp. 1–414, 8 pls., text illus., refs. London, 1955.

Of the 38 papers read at this meeting and here printed in full, over one-third contain information on insect pests or on insecticides used against them. In addition to two noticed elsewhere [*R.A.E.*, B **43** 119], these comprise: Research Trends in Canadian Agriculture and Forestry (pp. 45–64, 28 refs.), by K. W. Neatby, in which reference is made to work in eastern Canada on the long-term effects of spray schedules on insects and mites infesting apple [*cf.* A **43** 71, etc.] and on the bionomics and control of the spruce budworm, *Choristoneura fumiferana* (Clem.) [*cf.* A **43** 83]; Problems of Food Storage in tropical Territories (pp. 85–97, 6 refs.), by D. W. Hall, in which special consideration is given to work on the control of pests of stored cereals and groundnuts in Africa; Biological Aspects and economic Problems of Stored-products Entomology in temperate Countries (pp. 98–103, 7 refs.), by F. R. Cann; Progress in the Control of Insects infesting stored Foodstuffs (pp. 104–111), by E. A. Parkin; Past and Present Trends in Plant Virus Research (pp. 115–121, 42 refs.), by K. M. Smith, which includes a brief review of the relations of Aphids and Jassids to the viruses transmitted by them; The Spread and Control of Plant Virus Diseases (pp. 140–147), by F. C. Bawden, which includes notes on the

control of Aphids that transmit virus diseases of field crops; Biological Control of Insect Pests (pp. 190–196, 2 refs.), by T. H. C. Taylor, in which the advantages and limitations of the control of insects by the introduction of parasites and predators are assessed; The Development in Research and Control of some important Soil-borne Insect Pests (pp. 228–231, 6 refs.), by J. Doeksen, in which investigations on wireworms and their control in Holland are reviewed; Some basic Problems in the Application of Chemistry to Crop Protection (pp. 275–281, 12 refs.), by Hubert Martin, which deals largely with insecticide research; Application Methods for Crop Protection Chemicals (pp. 288–324, 2 pls., 2 graphs, 3½ pp. refs.), by W. E. Ripper, in which the application of insecticides in various ways and problems connected with it are discussed; The Contribution of Commerce to Crop Protection (pp. 325–332, 6 refs.), by E. Holmes, in which the part played by manufacturers in the development of new insecticides and other chemicals used in plant protection is emphasised; and Potato Aphids and Virus Diseases in the Netherlands (pp. 355–360, 9 refs.), by D. Hille Ris Lambers, which deals particularly with work directed to the forecasting of infestation of potato by *Myzus persicae* (Sulz.) in Holland.

Bracey (P.) & Barlow (F.). **Urea-formaldehyde Resin as a Vehicle for semi-permanent insecticidal and fungicidal Coatings on Bookbindings and Bookcases.**—*J. Document.* **9** no. 3 pp. 157–168, 2 pls., 11 refs. London, 1953.

Books are subject to injury by numerous insects, including those that feed on the starch glues and pastes used in the binding, cellulose feeders, which attack the paper, book cloths and book boards, and protein feeders, which attack leather and other animal matter used in book bindings. Since the inclusion of poisons or repellents in the binding glue or paste may require special precautions, affect the properties of the paste or other book materials or fail to protect the whole books, attention was directed to the use of coatings of urea-formaldehyde resin containing insecticides in solid solution. These are generally so formulated that a contact insecticide such as DDT blooms on the surface of the coating in response to mechanical stimulation such as that provided by the movement of insect pests or by cleaning operations. If removed by cleaning, they are regenerated by the accompanying stimulation after an interval that depends on hardness and other factors, but does not usually exceed a few days. The contact toxicity of the film is temporarily lowered by removal of the bloom, and where this would be undesirable, a volatile insecticide can be added. Volatile materials such as aldrin or BHC need not be made to produce a solid bloom, as the vapour alone is insecticidal.

In laboratory tests, samples of book cloth were painted with a urea-resin lacquer, with and without DDT equal to 5 per cent. of the weight of the resin solids, folded into sandwiches containing a thick paste of wholemeal flour and exposed for three days to adults of *Tenebrio molitor* L. Sandwiches of untreated book cloth were attacked at once, but cloth treated with the lacquer with or without DDT were not injured. In tests in which similar sandwiches were exposed for nine days or three weeks to adults of *Blatta orientalis* L., untreated cloth was damaged, that painted with resin only was slightly attacked and that treated with resin containing DDT was not injured. No bloom of DDT crystals was visible, and the lacquer appeared to have had no bad effect on the book cloth after six months. When detached book bindings were painted with lacquers containing 5 or 10 per cent. DDT or approximately 11 per cent. each of aldrin and dieldrin, adults of *B. orientalis* caged on them overnight were not affected by the

DDT formulations but were killed within 48 hours by the aldrin and dieldrin. A lacquer similar to the last that was subjected to numerous thorough cleanings with detergent and water over nearly 12 months retained its toxicity to cockroaches. The appearance of the covers was little affected and there was no weakness of the fabric along the hinge and no visible bloom of insecticide.

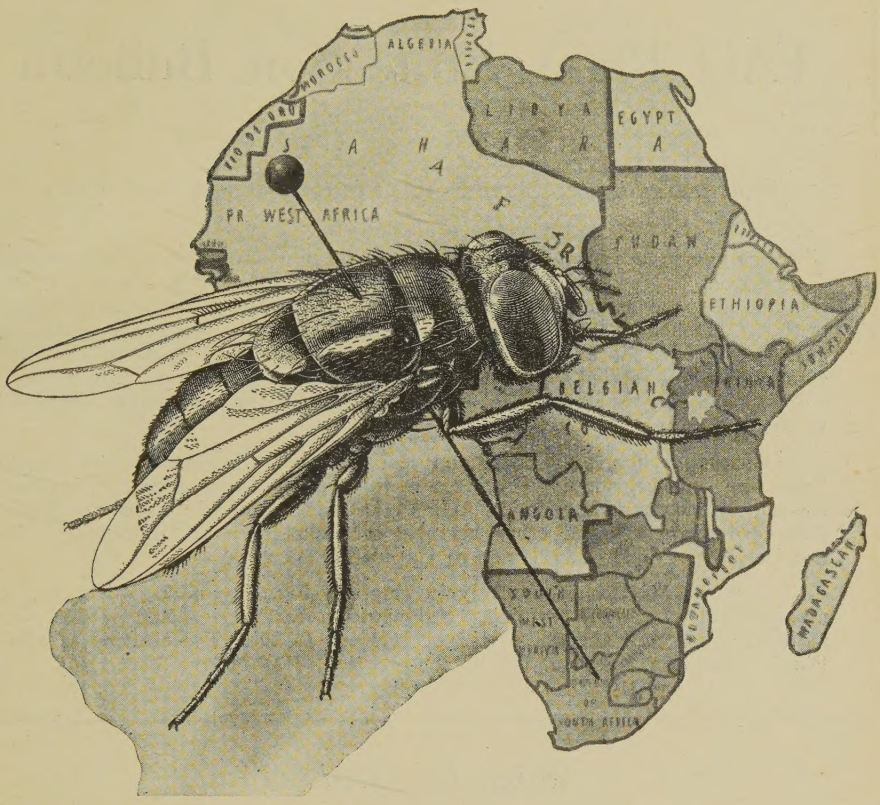
Further tests were made in a heavily infested library in which the books were rarely used. The insects found during the months before treatment comprised larvae of *Hofmannophila pseudospretella* (Stnt.), adults of *Niptus hololeucus* (Fald.), *Ptinus fur* (L.), *P. tectus* Boield. and *P. sexpunctatus* Panz. and undetermined Ptinid larvae, and there was evidence of earlier infestation by *Anobium punctatum* (Deg.). In view of the diversity of insects present, the shelves and back of one bookcase and the leather-bound books in it were painted with an air-drying lacquer containing 5 per cent. pentachlorophenol and 2 per cent. γ BHC calculated on the weight of the resin solids, or with a similar one containing no BHC and only 1 per cent. pentachlorophenol, at the rate of about 56 gm. per sq. yard in February 1952. No further deposits of débris such as originate from bindings eaten by insects were found on the treated shelves, and no insects were observed until mid-June, when one adult of *Corynetes coeruleus* (Deg.) (which is predacious on *Xestobium rufovillosum* (Deg.)), Ptinid larvae, and two Thysanura (probably *Lepisma saccharina* L.), all dead, and one living adult of *Blaps mucronata* Latr., apparently suffering from the effects of BHC, were found. Insect activity continued in untreated bookcases.

Examination of the books six months after treatment revealed no deterioration of paper or of leather bindings, but both shelves and bindings were rendered smooth and glossy; this change in the surface of the leather would be of no importance in a technical library, but would be considered as irreparable damage in the case of ancient books. The observations suggested that treatment of the shelves only with a coating formulated to produce an insecticidal bloom might be adequate for the protection of library books. Details are given of formulations suitable for use against insects that attack the three types of food available in libraries, with notes on the site of treatment. The application of insecticidal and fungicidal coatings to the book cloths and endpapers before the binding of books intended for heavily infested areas is recommended.

Papers noticed by Title only.

Thompson (W. R.). Ed. **A Catalogue of the Parasites and Predators of Insect Pests. Section 2. Host Parasite Catalogue. Part 3. Hosts of the Hymenoptera (Calliceratid to Evaniid).**—10¾ × 8¼ ins., pp. [3+] 191–332, multigraph. Ottawa, Ont., Commonw. Inst. biol. Contr., 1954. Price $ (Canad.) 4.20. (Also obtainable from the Commonw. agric. Bur., Farnham Royal, Bucks, price £1 10*s*.) [*Cf. R.A.E.*, **32** 106; **42** 136.]

Ferris (G. F.). **Atlas of the Scale Insects of North America. Volume VII. The Families Aclerdidae, Asterolecaniidae, Conchaspididae, Dactylopiidae, and Lacciferidae.**—11 × 8½ ins., pp. iii + 1–233, 94 figs., planographed. Stanford Univ. Pr., Calif.; London, G. Cumberlege, Oxford Univ. Pr., 1955. Price $ 7.50. [*Cf. R.A.E.*, A **25** 595; **41** 336, etc.]



The case of *Lucilia cuprina* . . .

Ever since man first herded sheep, blowfly ' strike ' has been one of the deadliest menaces to the health of the flock. Blowflies deposit their eggs on the fleece and within a few hours maggots are eating into the flesh. Unless quick action is taken a valuable animal may meet an unpleasant death.

In recent years insecticides have been used with increasing effect to prevent blowfly attacks. Today, over the vast sheep rearing areas of the South African veldt, shepherds use dieldrin to protect their flocks from the locally dominant blowfly *L. cuprina*. Dieldrin, developed by Shell, is so persistent that one spraying, harmless to the sheep, gives full protection for 3 months, or longer. Grubs hatching from eggs laid on the fleece die before they can penetrate the skin.

Where dieldrin guards the flock, the constant watch for blowfly is unnecessary, and a major source of loss to the sheep farmer is eliminated.

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THIS Bulletin is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

Manuscripts for publication, or correspondence regarding the World Reporting Service, should be addressed to Dr. Lee Ling, Plant Production Branch, Agriculture Division, FAO, Viale delle Terme di Caracalla, Rome, Italy; subscriptions and other business correspondence to Documents Sales Service, FAO, Viale delle Terme di Caracalla, Rome, Italy.

The Bulletin is issued monthly in English, French, and Spanish, twelve numbers constituting a volume. Subscription rates are $3.00 or 15s. per annum; single numbers are priced at $0.30 or 1s. 6d. The citation is FAO Plant Protection Bulletin, or, in abbreviation, FAO Plant Prot. Bull.

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Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by The Eastern Press, Ltd., London and Reading.

(1883) Wt. P8522/3895 8/55 E.P. Ltd. Gp. 566. [A]